SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXIX.—No. 18. [NEW SERIES.] NEW YORK, NOVEMBER 2, 1878. [$3.20 per Annum. [POSTAGE PREPAID.]

Chard's Lubricene and Cups.

The secret of economical lubricating lies in the application of a durable lubricator exactly when and where it is needed, without failure and without excess. This end appears to be very happily attained by the lubricating cups manufactured by Mr. R. J Chard, 134 Maiden Lane, New York city, and illustrated in our issue of August 17 last. The cups are charged with "lubricene," prepared from oil by a patented process, and the feeding is so arranged as to secure the uniform lubrication of bearings without waste and at the lowest cost. As was shown in the engraving referred to, page 100, a copper feeder passes through the lubricene in the cup and rests upon the bearing. Copper being a good conductor of heat, the feeder will be warmed by friction enough to secure a sufficient flow of the lubricant while the bearing is comparatively cool. The spring to the feeder is regulated by a screw cap so as to increase or diminish the feed according to the requirements of the bearing, thus giving a perfectly automatic friction feeding cup.

It is often asked how one man can run his mill and make money while his neighbor, who works just as hard, falls behind. The difference may often be found in the single circumstance that the one takes advantage of every real improvement bearing on his work, and reaps a benefit that the other misses. In the items of economy, proper lubrication is not insignificant. With every diminution in friction there is an equal saving of power, and very often a not less important saving in time. We are informed that the test of everyday use sustains the decision of the American Institute, in 1875, as to the superiority of this lubricant, as well as that of the judges of the Centennial Exhibition in regard to the unequaled excellence of Mr. Chard's lubricating cup and compound.

THE FORSTER-FIRMIN AMALGAMATOR.

In our issue of December 22, 1877, we illustrated the system of amalgamating the precious metals patented by Messrs. Forster and Firmin, of Norristown, Pa., which brought to the inventors inquiries from all parts of the world.

In this process the mercury is atomized by steam, compressed air, water, or other equivalent medium, and forced, after the manner of the well known sand blast, through a stream of falling ore, which may be either dry or wet.

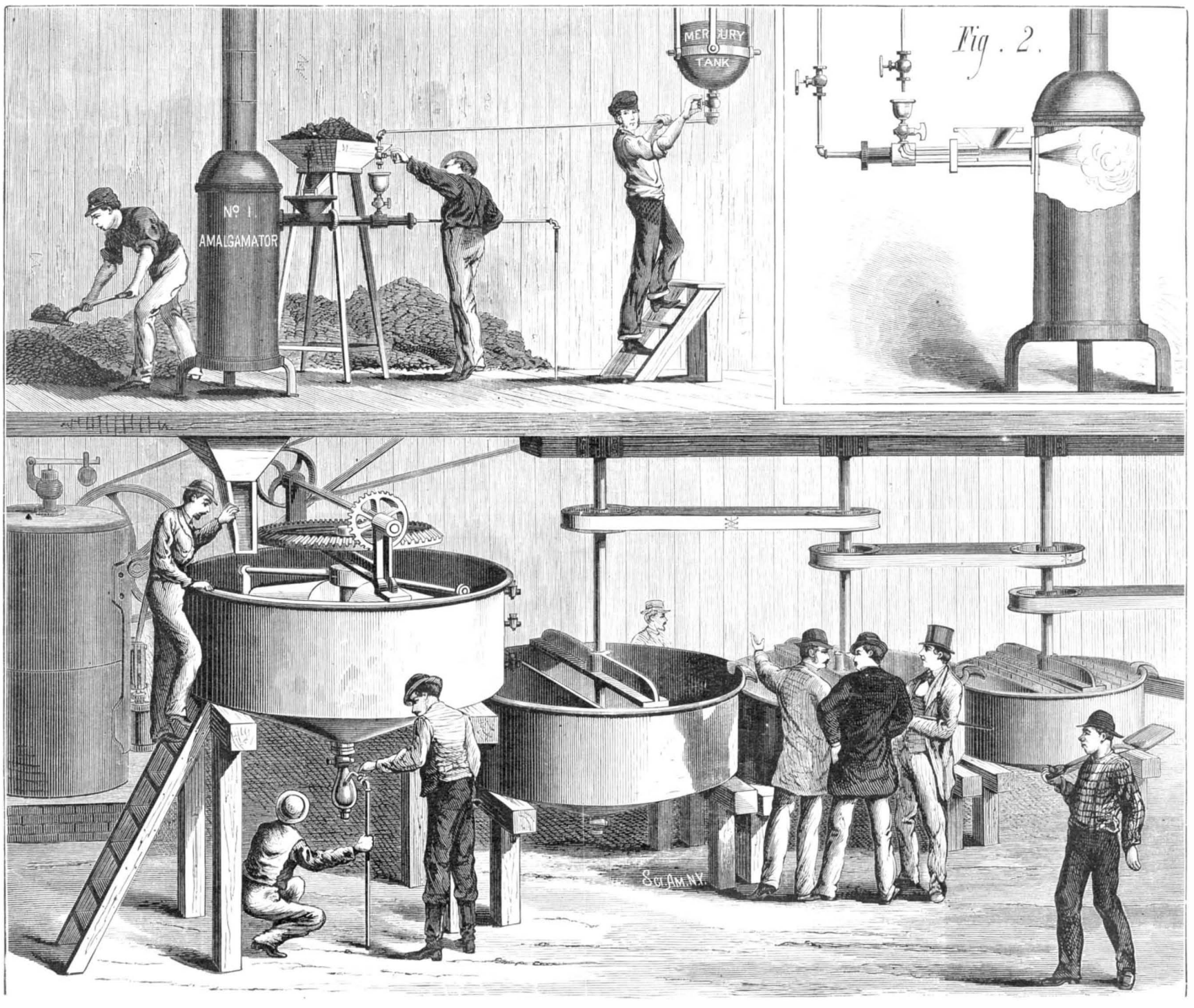
Since the description above referred to the inventors of this amalgamator have been conducting practical experiments which have resulted in important modifications and improvements, which increase the efficiency of the machines and reduce both the time and expense of working. In addition to the improvements in the amalgamator proper, Messrs. Forster and Firmin have perfected and patented a system of settlers, the advantages of which will be obvious to the practical miner. These settlers are arranged as shown in the engraving below, and each consists of a cylindrical vessel with a conical bottom, containing an agitator, and having a partition extending from the top of the vessel nearly to the upper side of the agitator. The pulverized ore, containing free gold or silver, is fed from the hopper to the horizontal tube which leads to the large vertical tube or chamber, shown in section in Fig. 2.

While in the act of falling the ore is impinged upon by a stream of mercury which escapes from the small receptacle at the rear of the hopper through an inner pipe. The flow of ore and mercury is broken up and carried forward by steam or air pressure. The ore which flows from the amalgamator is discharged into the washer, where it is heated by steam and worked for a short time until it is mulched sufficiently to flow evenly. Water is then injected into the chamber at the bottom of the washer, when the bulk of the mercury and amalgam is withdrawn, and the waste flows into the first settler of the series, and the water passes on until it finally escapes from the lower settler. The mercury is deposited in the central conical space in the vessels, from which it is removed occasionally through the discharge cocks. One of the settlers is provided with amalgamated copper plates, which are vibrated by the action of the water. This effects the arrest of the fine particles of gold or mercury carried in the water as it passes between them, while any gold leaf which may float on the surface is retained by the partitions. The process of amalgamating in this apparatus is continuous.

Fig. 3, page 271, is a modification in the amalgamator, in which three or more jets of mingled ore and mercury meet in a common center in the receiver or chamber, and intimately mixed.

The inventors state that with their apparatus they have obtained the entire quantity of metal contained in the ore, and have recovered from 98 to 100 per cent of the mercury used, the whole operation from the commencement to the

[*Continued on page* 274.]



THE FORSTER-FIRMIN AMALGAMATOR.

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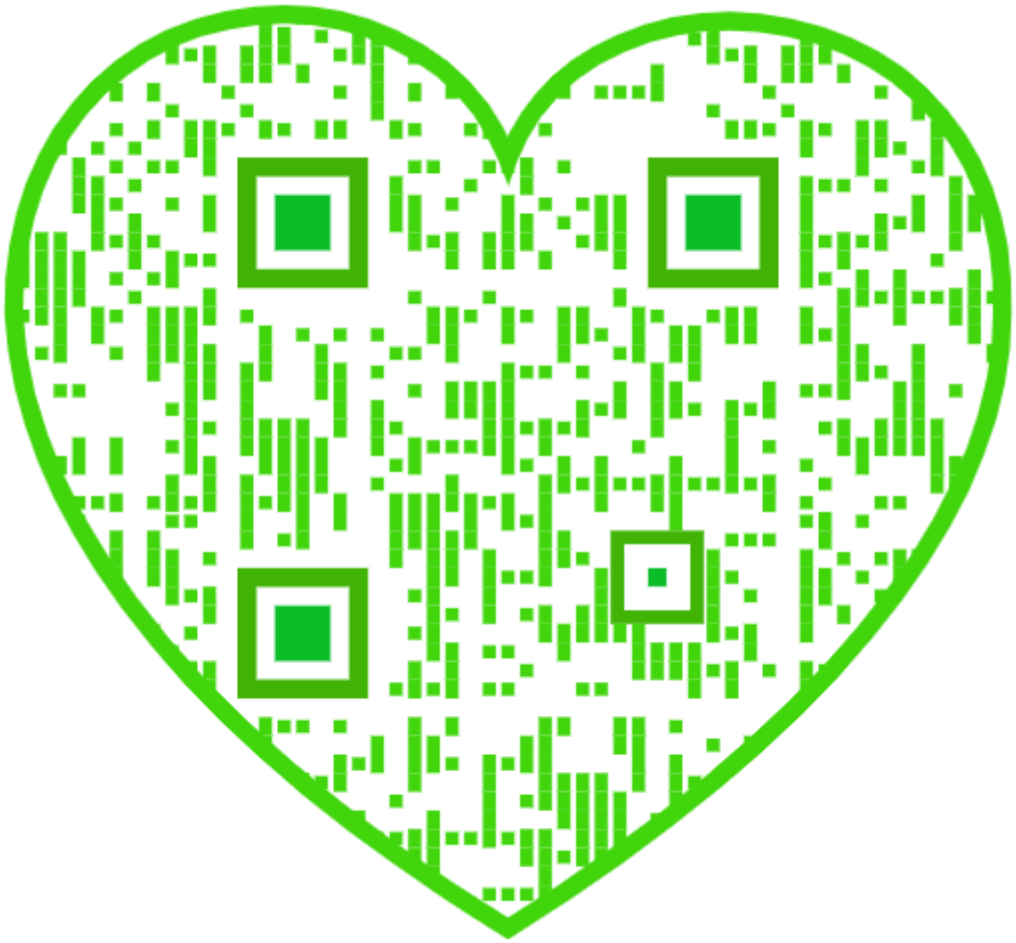

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NEW YORK, SATURDAY, NOVEMBER 2, 1878.

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THE ELECTRIC LIGHT AND THE GAS COMPANIES.—REMARKABLE EFFECT OF A NEW INVENTION IN THE STOCK MARKETS.

The announcement that Mr. Edison has discovered a means for dividing the electric current indefinitely, thereby making it possible to use electricity for lighting small areas, has had a marvelous effect in bringing down the value of gas stocks. The stock of the Chartered Gas Company of London, for example, has been depreciated in the market between five and ten million dollars, if we may trust a statement made before a recent meeting of the company. At an auction sale of gas stock in this city, October 16, shares of the New York Gaslight Company, that on September 11 brought 91¾, sold for 78½. Shares of the Manhattan Company that sold for 200½ in September went for 149½. Whether this enormous falling off in value in six weeks is to be charged entirely to the fear of electric competition does not appear; but evidently the larger part of it is, for a similar decline is noticeable in other places. Is there any sufficient reason for it?

The manufacturers of gas say that there is none; that the electric light is simply a co-ordinate branch of illumination, and not nearly so dangerous a competitor as the petroleum light is. The electric light may answer and be economical for lighting large spaces from a single source; but even that is made doubtful by recent improvements in large gas burners, with which the increase in illuminating power is very much more rapid than the increase in the amount of gas consumed. The use of electricity for lighting rooms of moderate dimensions is declared impractical from the difficulty or impossibility of dividing the current sufficiently, and unprofitable from the rapid loss of power when the current is divided at all. As Professor Morton explained lately, when the intensity of the light is diminished by subdivison the percentage of light decreases enormously; so that where a given electric force, applied to one lamp, gives a light, say, of eighty burners, it will with two lamps give only as much light as thirty burners.

Whether Mr. Edison has overcome all these obstacles to the economical use of electricity in small lights remains to be proved. Nevertheless his invention seems to have been the occasion of something like a panic among the holders of gas stocks, a panic which would be foolish even were everything claimed for the invention absolutely true and certain; as a little unexcited thought with regard to the nature of gas, and the vast undeveloped fields of usefulness open to it, will show.

But what is Mr. Edison's discovery? A few words will suffice to give an idea of it. It is based on the well-known fact that a wire may be heated by an electric current, the basis of many attempts to accomplish what Mr. Edison claims to have done. The reader may have seen the gas jets of the dome of the Capitol at Washington, lighted by similar means. Over each burner is placed a coil of platinum wire, which, when heated by the electric current, ignites the gas. Mr. Edison uses the coil itself as the source of light, the current sent through it being strong enough to make the coil white hot, or self luminous. The difficulty to be overcome at this point was the liability of the wire to fuse and spoil the light; a difficulty which Mr. Edison claims to have obviated by the introduction of a simple device which, by the expansion of a small bar the instant the heat of the coil approaches the fusing point of platinum, interposes a check to the flow of the current through the coil. This automatic arrangement, in connection with an auxiliary resistance coil, secures, it is said, an even flow of electricity through the coil, and consequently a steady glow of pure light. If this is done economically it is obvious that a marked advance has been made in artificial illumination.

Must gas go out in consequence? Our opinion to the contrary has already been expressed. The communication from Mr. Strong relative to the use of gas as fuel may be read with interest in this connection; it will be found in another column. The enormous capital invested in gas works and street mains is in no danger of being made useless. Whatever may come out of the electric light, the demand for gas is sure to increase enormously. By recent improvements in the processes of gas-making it has become possible to supply this most perfect fuel at rates which must rapidly do away with all other fuels for most domestic and other purposes; and it is quite possible that the gas that will be required for supplying power for the generation of electricity, supposing the use of electricity to extend as its advocates claim, will amply compensate for all that is likely to be withdrawn from public consumption by the advances of the new light. At all events the holders of gas-stocks will do well not to sacrifice their property in consequence of this temporary and uncalled-for flurry.

PROGRESS IN ENGLAND AND AMERICA.

The Right Honorable W. E. Gladstone, Member of Parliament, and lately the leading spirit in English political affairs, contributed to the *North American Review* (September–October, 1878) a notable paper entitled "Kin Beyond Sea," a paper chiefly devoted to a comparative study of American and British institutions. Mr. Gladstone saw fit, however, to make a few preliminary remarks, in the course of which, speaking of the United States, he said:

"I do not speak of political controversies between them and us, which are happily, as I trust, at an end. I do not speak of the vast contribution which, from year to year, through the operations of a colossal trade, each makes to the wealth and comfort of the other; nor of the friendly controversy, which in its own place it might be well to raise, between the leanings of America to protectionism, and the more daring reliance of the old country upon free and unrestricted intercourse with all the world; nor of the menace which, in the prospective development of her resources, America offers to the commercial pre-eminence of England. On this subject I will only say that it is she alone who, at a coming time, can, and probably will, wrest from us that commercial primacy. We have no title, I have no inclination, to murmur at the prospect. If she acquires it, she will make the acquisition by the right of the strongest; but, in this instance, the strongest means the best. She will probably become what we are now, the head servant in the great household of the world, the employer of all employed, because her service will be the most and ablest. We have no more title against her than Venice, or Genoa, or Holland has had against us. One great duty is entailed upon us which we, unfortunately, neglect—the duty of preparing, by a resolute and sturdy effort, to reduce our public burdens, in preparation for a day when we shall probably have less capacity than we have now to bear them."

To the American mind all this seems no more startling or unreasonable than if Mr. Gladstone had stated the commonplace geographical fact that the sun shines every day on America after it has set in England. Bishop Berkeley's star of empire takes its way westward as surely and as inevitably as the sun, and no man deserves any great amount of credit or of discredit for frankly recognizing the fact.

It seems, however, that it is a very risky thing to do in England, particularly if it is done by one in Mr. Gladstone's position. At any rate the British journals express their disapproval of Mr. Gladstone's utterance in as vigorous terms as they have at command.

As Americans we must confess that we see no occasion for such a flurry; much less occasion for accusing Mr. Gladstone of predicting the rapid decadence of his own country. Indeed, it is only too apparent that a determination to find fault with a great man in temporary disfavor for his opposition to the present drift of imperial policy, rather than anything actually said by him, is the impelling cause of this outburst of passion.

It is in the nature of things that, with the life and energy of the Anglo-Saxon race, re-enforced by the best elements of all Britain and half of Europe, with British institutions as a basis, and almost unlimited territory to flourish in, America should ultimately become greater and more powerful than the small island which has hitherto been the center and seat of Anglo-Saxondom. Australia must sooner or later outstrip England in like manner, and Canada also; and who knows what other future nations, speaking English speech, in Africa, Asia, or the islands of the Pacific? Surely every true Englishman must feel that England's highest glory is in these, her stalwart children, whether England maintains political supremacy or not. It must be sheer Cockneyism, inspired by party spirit, therefore, that makes the *Graphic* "suspect" that hatred of the Americans would be the only outcome of a recognition of the destiny which Mr. Gladstone foresees. The better minds of Great Britain have already adjusted themselves to the existence of the Greater Britain that Sir Charles Dilke has so well described; and the circumstance that the larger part of that Greater Britain was driven to political independence by an old-time attempt to arrest the inevitable, should emphasize the folly of keeping up the needless struggle, even in spirit. It is too late to discuss the question whether America would have been greater or less successful, as a nation, under such government as England now accords her colonies. Had such a policy been possible to England without the American rebellion, the rebellion would never have occurred. As it is, the undetached portions of the Greater Britain are largely indebted to the American colonies for the liberties they enjoy. And England is, to-day, in consequence of America, a greater power than she could have been in the absence of the contributions which free America has made to her commercial and industrial prosperity. If primacy in these fields of human enterprise is to fall to and remain with the United States, the change will be attributable not to England's decay, but rather to the relatively more rapid growth of America, made possible by material advantages and a more numerous population.

THE INCOMING COMMISSIONER OF PATENTS.

The newly appointed Commissioner of Patents, Gen. Halbert E. Paine, brings to his delicate and responsible position an excellent record for capacity and efficiency.

General Paine comes of honorable stock; and from the days when his grandfather thrice removed fought in the old colonial wars, down to the present, there have not lacked men of his name who have ably served their country in the field and in responsible places in civil life. Born in 1826, he was graduated at the Western Reserve College at the head of his class in 1845, and admitted to the bar four years later. His military title was won by hard service in the war of the rebellion. Subsequently he was elected to Congress; first to the thirty ninth, again to the fortieth, and yet again to the forty-first. In his Congressional service the high reputation he had won in the army for sterling capacity and integrity in the conduct of affairs was admirably sustained. He was at the head of the Committee on Militia, served on the Committee on Reconstruction during its whole existence, and was successively member and chairman of the Committee on Elections, in which onerous and difficult position he compelled the admiration of political opponents as well as

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party friends. To him is credited also the perfection and passage of the Signal Service Act.

At the expiration of the Forty-first Congress, General Paine refused to stand again, preferring to return to the practice of his profession. He established himself at Washington, where he has since resided. A short time since he was offered the post of Assistant Secretary of the Interior, but declined. His acceptance of the Commissionership of Patents will, we trust, prove eminently satisfactory to himself and to the country.

Touching his plan of action in the new field, General Paine lately declined to speak further than to say that he had given the subject some thought and viewed his approaching duties witnout apprehension. He knew the position to be an arduous one to fill, furnishing work enough to keep the most ambitious incumbent busy; the arrangement of details he would leave to the observation and conclusions of occupancy. In view of General Paine's long acquaintance and professional association with the Secretary of the Interior, it is believed that his appointment will prove advantageous to the Patent Office, in insuring perfect harmony between it and the ruling department. Inventors, and all likely to have business to do with the Patent Office, will be pleased to know that promptness and thoroughness will characterize the working of the Office under the new rule.

SUCCESS OF AMERICAN EXHIBITORS AT PARIS.

The number of awards to American exhibitors at the French Exhibition has been officially announced, and far exceeds any estimate previously made. They comprise ten grand prizes, thirty diplomas of honor, one hundred and thirty-four gold medals, two hundred silver medals, two hundred and twenty bronze medals, and one hundred and fifty-six honorable mentions. The aggregate is larger than the whole number of American exhibitors at the Paris Exposition in 1867, or at the Vienna Exposition of 1873. Relative to the number of exhibitors the prize winners of America exceed in number those of any other nation. This last point is especially significant, as the highest evidence of the superior character of our mechanical and industrial products. The effect of these victories upon our foreign trade, and thus directly upon our many industries, can scarcely be overestimated.

SHOULD THE NATION ENGAGE IN MANUFACTURES?

The extension of the scope and capacity of our government establishments for the manufacture of military and naval stores, contemplated by the Ordnance Department, has called out a long and very instructive review of the government arsenals and private establishments of the country, will be published in full in the next issue of the SCIENTIFIC AMERICAN SUPPLEMENT. The purpose of the writer is to show that it is neither necessary nor advantageous to the nation to enter thus into competition with private enterprise.

On the score of economy, it is shown that the various articles furnished by the government arsenals cost more and are of inferior quality, compared with the products of private establishments. The estimated cost of the Springfield rifle, for example, at the Springfield armory, is $54; yet private companies are willing to furnish in quantity an identical arm for $14. The cost of trowel bayonets to the government is $4 each; they would be furnished by a Massachusetts manufacturing company for $2.25. That our private establishments are capable of meeting any probable demand from the nation is evident from the promptness with which they supplied the armies of Russia and Turkey in the late war. It is certain that neither the existing arsenals, nor any that the government is likely to establish, could ever approach our numerous private establishments in capacity, except in the manufacture of heavy guns. The South Boston Iron Company is the only one in the country that has the plant necessary for the manufacture of the heaviest ordnance; and this would probably be rendered valueless if the plan of the Ordnance Department were carried out.

The nations which have the best field guns and heavy ordnance in the world are England and Germany; and their superiority is attributed to the circumstance that those governments have liberally appropriated money for the manufacture of guns, and the contracts have been given to private manufacturers. Had the United States followed their example, it is argued, we might at the present time be exporters of heavy and light guns and carriages and projectiles, and have the whole world for customers, as well as exporters of small arms and small arm ammunition. Whitworth and Armstrong and Krupp are able to supply superior guns for half the world, because their respective governments have aided them by liberal orders. If our government would do likewise, it is claimed, the American makers of heavy ordnance and projectiles would soon be able to compete with the best, and a large foreign trade might be built up. The direct result would be that the country would be far better armed than now, at far less cost, and at the same time the foreign trade made possible would give employment to millions of money and thousands of men.

The government is a large consumer of paper and envelopes; it does not find it necessary, however, to engage in the manufacture of these commodities. By giving its contracts to the lowest bidder the government gets what it requires at much lower rates, probably, than government mills could secure, and at the same time advances private enterprise, instead of counteracting it. True, in selling stamped envelopes at cost, the government interferes materially in the free competition of envelope makers, and secures to the public a necessary article at prices much below what would otherwise prevail; but that is an incidental feature not likely to arise in the case of other manufactures.

FUEL GAS.

The heating gas made by what is known as the "Strong Process" has recently been the subject of critical scientific investigation by several well-known chemists and experts. The report upon the process by Prof. Gideon E. Moore, Ph.D., is most thorough, and affords ample indorsement of the belief so rapidly gaining ground that the solid must give way to the gaseous form of fuel, at least in our city homes.

Without attempting a general review of Dr. Moore's determinations, it will be sufficient to state that the gas is found to be of the following constitution, having a specific gravity of 0·54008:

Oxygen	·77
Carbonic acid	2·05
Nitrogen	4·43
Carbonic oxide	35·88
Hydrogen	52·76
Marsh gas	4·11
	100·00

This analysis presents a composition, ninety-three (93) per cent of which is formed of the three most valuable heat-producing gases known to science.

Dr. Van der Weyde, whose researches in gas chemistry entitle him to great respect, and who has made the Strong gas the subject of careful study, gives an analysis wherein ninety-six (96) per cent of the entire volume of this gas is composed of the three combustibles named. Upon these determinations we should naturally expect a very high theoretical flame temperature. This Dr. Moore finds to be 5,482·9° F., or about 900° F. higher than that of ordinary illuminating coal gas. Since it is free from what are termed the illuminants, no deposition of carbon is possible during its combustion. These two features—the high calorific power and the smokeless character of the flame of this gas—indicate its superior fitness for a fuel. We are not left in doubt on this point, for a careful observation of its behavior in the melting and puddling of iron and in the raising of steam sustains the inference, in fact forces the conviction, that not only in the arts and manufactures, but more especially in domestic use, it will take the place of solid fuel, provided the question of economy is also clearly established. Concerning this vital point, we print the following letter from the inventor:

OFFICE, 87 ASTOR HOUSE, September, 1878.

To the Editor of the Scientific American:

SIR—The recent announcement in the journals of Mr. Edison's discovery of a way to subdivide the electric current whereby it is practicable to employ electricity for domestic illumination at a fraction of the cost of coal gas, seems to have caused some uneasiness in the minds of the gaslighting fraternity.

Without entering into any discussion as to the merits of Mr. Edison's alleged discovery, or its precise bearing upon the business of gaslighting as now conducted, I desire to suggest the possibility of its being to the coal-gas men a "blessing in disguise."

Should electric supersede gas lighting, how shall the gas companies employ their plant? The coming change from solid to gaseous fuel affords an answer, and suggests a use for their buildings, holders, mains, and meters, both day and night, to an extent far beyond the present service, and at a profit which shall remind them of old times. That a non-luminous gas, similar to that investigated by Dr. Moore, is, in point of efficiency, convenience, comfort, and health, vastly superior to coal in cooking our food and warming our houses, no one can doubt who has any knowledge of the subject. The question is, Will it prove *economical?*

In England the application of ordinary illuminating gas to fuel purposes has been far more extensive than in this country, and the evidence is conclusive that it is there effecting a decided economy in domestic life. To be sure, gas in London and Liverpool is supplied at about one dollar per thousand cubic feet, but we must not forget that coal is proportionately cheap. In this country, while the use of gas as a fuel has been limited, there is ample evidence that for cooking it is cheaper than coal, even when the price charged is $2.50 per thousand cubic feet. When I say cheaper I mean *intrinsically* cheaper, and take no account of the collateral points of economy, to wit, that its use saves time and labor, avoids dirt and smoke, and preserves health, comfort, and good temper.

If this be true of illuminating gas, what shall be said of a pure, non-luminous gas, the perfect combustion of which may be attained without the intervention of Bunsen burners or the pre-admixture of air, and which can be supplied to the consumer at one-fifth the price of ordinary coal gas?

Gas companies are not usually communicative as to the cost of gas either in the holder or at the consumer's meter.

Considerable experience enables me to say that in New York and Brooklyn the manufacturing cost of coal gas is not less than sixty cents per thousand, but I desire to be on record as asserting that the heating gas of which we are speaking can be in most of our Northern seaboard cities manufactured and delivered into the holder ready for distribution at a cost not exceeding ten cents per thousand, where the production is equal to one million cubic feet daily. Your engineering readers can estimate the cost of delivery for themselves, bearing in mind, however, these three important facts: *First*, this gas is absolutely non-condensible in the sense in which that term is usually employed by gas men, and therefore a large source of loss in the distribution of illuminating gas may be ignored in this estimate. *Second*, since the volume of heating gas required throughout a given district will be largely in excess of the volume demanded for light, the percentage of leakage through defective mains will be proportionally less. *Third*, the loss in dollars and cents by leakage will be in proportion to the respective cost of the two gases.

Truly yours,

M. H. STRONG.

AN IMPROVEMENT ON TEA CHROMOS.

The desire to have something "thrown in" with every purchase, a desire apparently very prevalent among the less intelligent classes of humanity, leads to some comical results in trade. Multitudes of people have cheerfully paid two dollars and a half for a paper they didn't want, for the sake of getting a fifty cent chromo. And to judge from the windows of uptown tea and coffee shops and corner groceries, the gift of a ten cent picture or a chance to win a pair of ugly vases is a much more powerful attraction to small buyers than superior goods or moderate prices. The absurdity of expecting shop keepers to give away something for nothing, even when that something is intrinsically worthless, does not seem to appear to the customers of such prize giving shops. They always have something thrown in, and that insures a good bargain.

The practice began, we believe, in England, where it is still a profitable "dodge." The only drawback seems to be that people ultimately get their houses fully stocked with pictures and other trumpery, and then they want something more substantial. This has led a Glasgow house to introduce a "new system," which consists in giving each buyer of tea the sugar to sweeten it "for nothing," at the rate of four pounds of sugar for one pound of tea. How much more than the cost of the sugar they add to the price of the tea they prudently refrain from telling. Not to be outdone, a Swansea tea company offer to give on certain days a hat worth five shillings with every pound of tea, or if the purchaser prefers, a splendid silk necktie.

This is much better than chromos, even if the hat is not a work of art; and doubtless the tea is just as bad in the new system as in the old.

It is one of the misfortunes of people of narrow means that they have to buy the necessaries of life in small quantities, the ratio of profit to the seller usually increasing with every diminution of the size of the package. Yet it is safe to say that most poor people pay far more for their limited purchases than they might, were their buying more intelligently done. Indeed a frequent cause of poverty is the inability to turn thriftily the proceeds of industry. They never learn the lesson that while it is pleasant to think that the sugar is "thrown in" with the tea, they are sure to have to pay for it, perhaps doubly.

A SOUTH AUSTRALIAN OFFER FOR AN IMPROVEMENT.

South Australia is rapidly becoming a great grain-growing country; and, like all new countries, finds its capacity of production most seriously limited by the lack of labor, more correctly perhaps by a lack of labor low priced enough to enable producers to get their products to distant markets at a profit. The only solution of this difficult problem lies through the use of machinery which will make the labor of one man produce as much as many men can unaided. And lying further from the great grain markets of the world than other great grain producers, Australia has the more urgent need of machinery which will lessen the cost of her staple cereals. Accordingly the government of South Australia has offered a reward of $20,000 to the inventor of the "best machine combining within itself the various operations at the same time of reaping and cleaning, fit for bagging on the field, the various cereal crops of South Australia."

The competitors for the prize will be tested in December, 1879, with especial reference to their strength, durability, lightness of draught, cost, work done, results of cleaning, and simplicity. To win the prize the successful machine must be an improvement on any in use in the province; and then the bonus will be paid over only on condition that the successful competitor is debarred the privilege of patenting his machine. In other words, he will be allowed to patent his machine only on condition that he declines to receive the bonus.

To what extent American machines, accomplishing the ends in view, have been introduced into South Australia, we do not know; it is evident, however, that the competition, if there be any, will lie between such machines and possible improvements of them. It is evident, also, that the successful competitor will gain the lead in a very wide and advantageous market, from which the profits are likely to be far greater than the bonus offered. Our manufacturers and inventors may find the field worth cultivating.

A Correction.

Owing to the indistinctness of the photographs from which were made the drawings illustrating a horse's motion (SCIENTIFIC AMERICAN, October 19), the figures D and 9 were incorrectly drawn. It is clear, from a more critical study of the different strides, that the positions of the fore legs in D should be reversed, that is, the right leg should be straight and the left bent. Again, in 9, the left fore leg should be advanced and the right bent under the body.

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LYMAN'S TRIGONOMETER.

There is a wide contrast between the accuracy of engineers' field instruments and the draughting instruments used in the office. It is when the field notes are brought to the office, the engineer's troubles begin. His drawing boards warp: his rulers bend, or have not parallel edges; his rolling parallel rulers wear their wheels unequally; his T squares are never square; his glass triangles will not prove four times round a circle; his paper protractor is badly divided, or shrinks in one direction and is awkward to use; his horn, brass or ivory semicircles are wretchedly manufactured; his protractor makes holes in his paper, and is always in the way, and, if taken up, cannot be put down again true to the meridian; his scales are difficult to read and subdivide by the eye, stick to the paper, or slip too easily over it; and his prick point makes oval holes instead of circular ones, and not exactly at the division line of his scale.

Working under these disadvantages, it is no wonder that the engineer at his office table loses the keen zest for accuracy which characterizes him in the field. His lines are all more or less forced to a conclusion, and he feels but little disposition to carry his topographical work a single rod beyond compulsion.

To remedy these defects, Professor Josiah Lyman, of Lenox, Mass., many years since gave his study and experiment to protractors and scales. This resulted in the invention of the trigonometer shown in the accompanying engraving. It is an ingenious and strictly scientific combination, uniting in one machine the protractor, base bar, sliding square or T, and sliding scale.

The original instrument has been improved so that the under surface, including base and arm, is brought into the same plane with the draughting board or paper upon it, thus enabling the draughtsman to lay it flat upon any part thereof.

A steel bar is arranged so that it may be instantly clamped upon either the side or end borders of the board, or at right angles (at any point) across the board, or diagonally at any required angle across any one of its corners, upon which the trigonometer slides and to which it is held by spring force.

The better class of instruments are provided with a vernier plate capable of being shifted to right or left 45° or less, and there clamped during any given operation. This arrangement, however, is applied only to that class of the instruments which is furnished with a tangent fixture for nice motion. But the same facility is practically secured to the other class by means of the steel bar just described.

A sliding square, either of whose arms (ordinarily of 15 and 6 inches in length respectively) may be held in contact with either edge of the protractor arm.

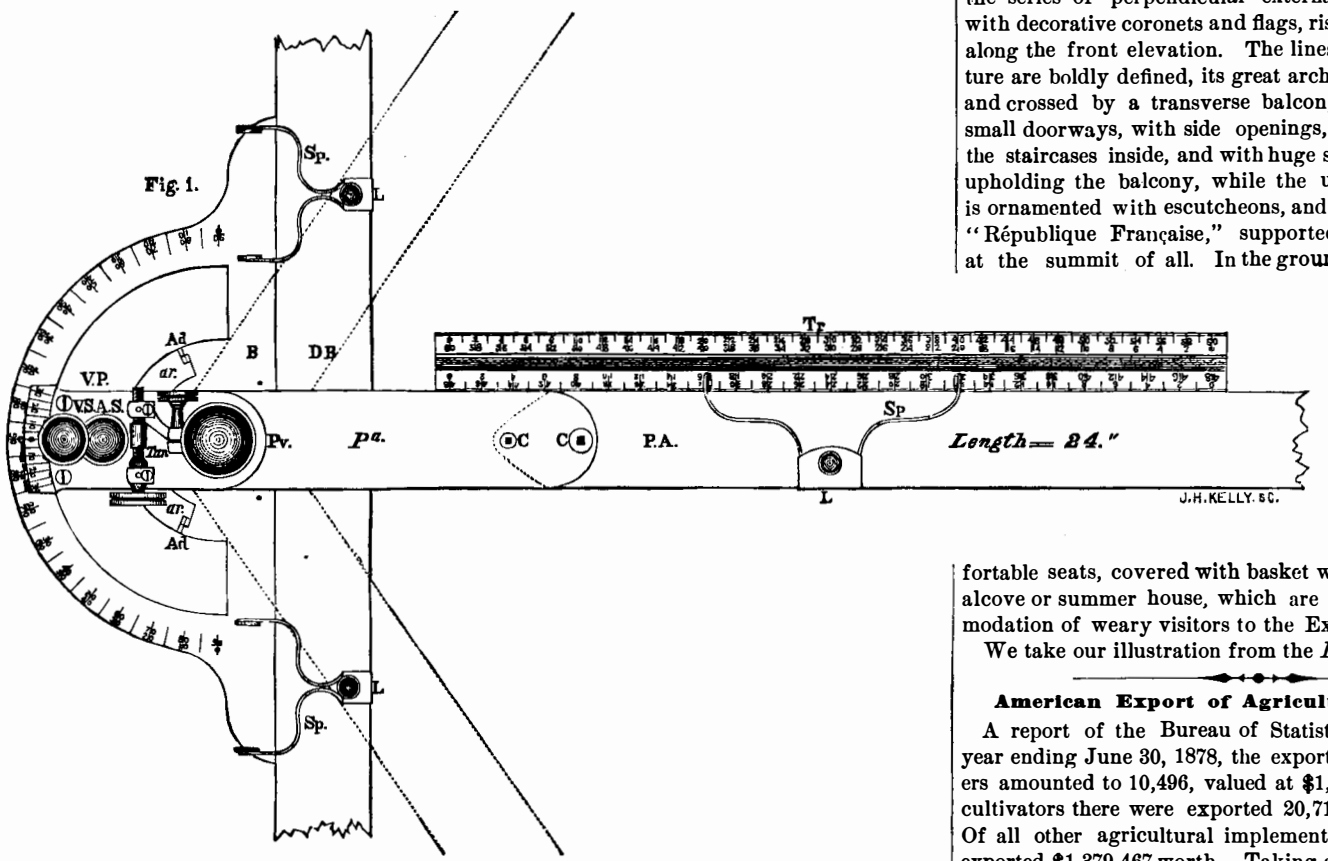
Triangular or trileaved scales may be used in connection with this instrument, being clamped by means of the springs S *p*.

The protractor plate, B, which constitutes the base of the trigonometer, is made of German silver or hard brass silver plated, about the twelfth of an inch thick, having a face usually 10 inches in length.

At an inch or a little less back from the face is inserted the pivot, P*v*, on which turns to right or left the arm of steel in two parts, namely, the attached part, *p a*, and the arm proper, P A. To the former is clamped the vernier plate, V P. This terminates in an arc, *ar*, of German silver, embracing about 135°, on whose limb are graduated two test marks, A *d*, A *d*, and corresponding with these two similar ones on the base plate underneath. By these the protractor plate is adjusted for clamping. The two parts of the arm are fastened together by the connecting screws, C, C, sufficient space between the arm proper and the protractor face being given to allow the instrument to play freely along the draughting or base bar, D B, at an angle of 55° or less. The arm proper is therefore readily detached from the other part, thus allowing another of different length to be readily attached in its stead.

On the limb of the protractor plate (graduated to half degrees, reading directly to minutes, or indirectly and reliably to half minutes) are two readings, the inner, giving the angle of the arm with reference to its meridian or zero line; and the outer, which gives the angle with reference to the protractor face. Hence every position of the arm indicates both the direct angle and the complement of the same. Therefore, in laying down the direct angle, the protractor arm only is required for guiding and operating the sliding scale; but in laying down the complementary angle, the sliding square is necessary; and this answers all the purposes of rectangular borders to the board.

This instrument may be applied to all problems for obtaining the varied lines and angles in architecture, or the construction of bridges or other similar works, with the sizes, forms, and position of all timbers, blocks of wood, stone or iron connected therewith.

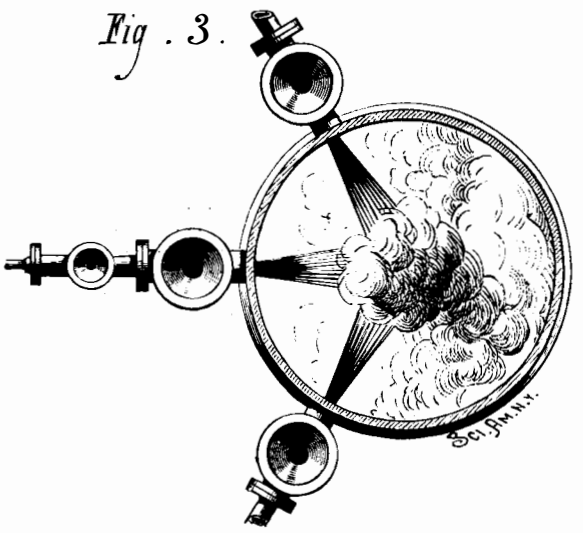


LYMAN'S TRIGONOMETER.

For the use of engineers in cross sectioning excavations of earth or rock, for railroads or canals, or any other similar work, it is convenient and expeditious. The same is true of its application to military fortifications, as well as in the construction of machinery in the navy yards or other public works. When known by mariners, it will often supersede the use of the tables in their daily labors.

It is also applicable to the mensuration of heights and distances, and especially to the projection of eclipses and other calculations connected with astronomy.

With the greatest facility and accuracy, therefore, may any desired operation of triangulation be effected or trigonometrical problems solved by the use of this instrument. It renders unnecessary in all cases traverse tables, and for most purposes even logarithms, saving in all ordinary trigonometrical calculations half to three fourths of the time and labor. With equal facility outlines of lots or tracts of land or other irregular figures may be plotted. Another very essential use of the trigonometer is in the division or laying out of lands. For further information address Professor Lyman, as above.



HORIZONTAL SECTION OF AMALGAMATOR.

THE FORSTER-FIRMIN AMALGAMATOR.

[*Continued from first page.*)

production of the amalgam being completed within one hour.

The inventors claim that by means of their apparatus a rapid and perfect amalgamation is effected at a low cost, thus rendering the working of poor ores profitable. Another advantage in this system is that apparatus which is already in use may be modified to partially or wholly conform to this system.

During a recent public trial of this apparatus silver ore was passed through a single amalgamator at the rate of 3,000 lbs. per hour; 99 per cent of silver and 97½ per cent of the mercury were recovered within an hour. During another similar trial ore was passed through at the rate of 3,600 lbs. per hour, 97·88 per cent of mercury and silver together were recovered in 45 minutes, and within half an hour (1¼ hour from the start) 97 per cent of the silver was crucibled; subsequently an additional quantity of amalgam was collected and treated, bringing up the result to fully 99 per cent of silver and 99½ per cent of mercury recovered. These trials were witnessed by eminent metallurgists and mining experts, who did not hesitate to express their satisfaction.

For further particulars see advertisement of the Forster-Firmin Gold and Silver Amalgamating Company, of Norristown, Pa., in our advertising columns.

The Poplar as a Lightning Conductor.

A fresh proof that the upper part of trees, especially of poplars, is an excellent conductor of electricity (which only rends or shatters the wood when it finds a passage in the trunk) is afforded by *Nature* in an account of the effects of lightning on an aspen (*Populus tremula*) situated in a wood near the château of Crans on the shore of the Lake of Geneva. The lightning chooses by preference the poplar as a conductor to reach the ground, and the case under consideration is a striking one, as the tree was surrounded by other kinds, particularly firs, taller than it. Two great branches, of 18 and 20 inches diameter, which surmounted it, were struck by the lightning, and led it to the ground without having received the least apparent injury, while the trunk below them was absolutely shattered. Other recent observations prove the preference of lightning for trees situated near the streams or reservoirs of water, so that the best conductor for a house is a lofty tree, a poplar especially, situated between the house and a well, a pond, or a neighboring stream.

THE PARIS EXHIBITION.

The main building, or Palace of the Exhibition, in the Champ de Mars, is represented in the engraving on the opposite page. This grand façade, raised above a prolonged terrace, with several approaches by steps, protected by curving balustrades, presents a central arched nave, of superior dimensions, with transepts extending far to the right and left, each terminated by a domed tower of four arched sides, which is supported by angle buttresses. This is the general form of the edifice, while its aspect is further relieved by the series of perpendicular external beams, surmounted with decorative coronets and flags, rising at certain intervals along the front elevation. The lines of the central structure are boldly defined, its great arch being deeply recessed, and crossed by a transverse balcony above the numerous small doorways, with side openings, which give a view of the staircases inside, and with huge scroll-shaped buttresses upholding the balcony, while the upper part of the arch is ornamented with escutcheons, and with the initials of the "République Française," supported by winged seraphs, at the summit of all. In the grounds on this side of the Exhibition Palace, along the broad graveled paths which cannot easily be overcrowded, there is ample space for a promenade in the fresh air; or a brief repose of body and mind can be enjoyed in the comfortable seats, covered with basket work to form a portable alcove or summer house, which are placed for the accommodation of weary visitors to the Exhibition.

We take our illustration from the *London News*.

American Export of Agricultural Machinery.

A report of the Bureau of Statistics shows that in the year ending June 30, 1878, the exports of mowers and reapers amounted to 10,496, valued at $1,018,916. Of plows and cultivators there were exported 20,710, valued at $154,977. Of all other agricultural implements and tools there was exported $1,379,467 worth. Taking all the exports grouped under the head of agricultural implements, the gain was nearly fifty per cent as compared with the same for 1877.

Dangers from Impure Potassium Iodide.

It appears from a discussion which took place recently at a meeting of the Society of Medical and Natural Sciences, at Brussels, that the greatest danger accompanies the administration of iodide of potassium containing a minute proportion of the iodate. Dr. Melsens, the learned Professor of Chemistry at the Veterinary School, in support of this statement detailed some experiments with dogs, in which these animals had rapidly succumbed after injection of iodide of potassium containing a mere trace of iodate. The question now to be solved is whether the iodate of potassium itself is a salt possessing such marked toxic properties, or whether its presence gives rise to a minute quantity of free iodine in contact with the blood. At all events, it is a subject that will undoubtedly attract a good deal of attention, and points at once to the absolute necessity of having for pharmaceutical use nothing but iodide of potassium that is chemically pure.

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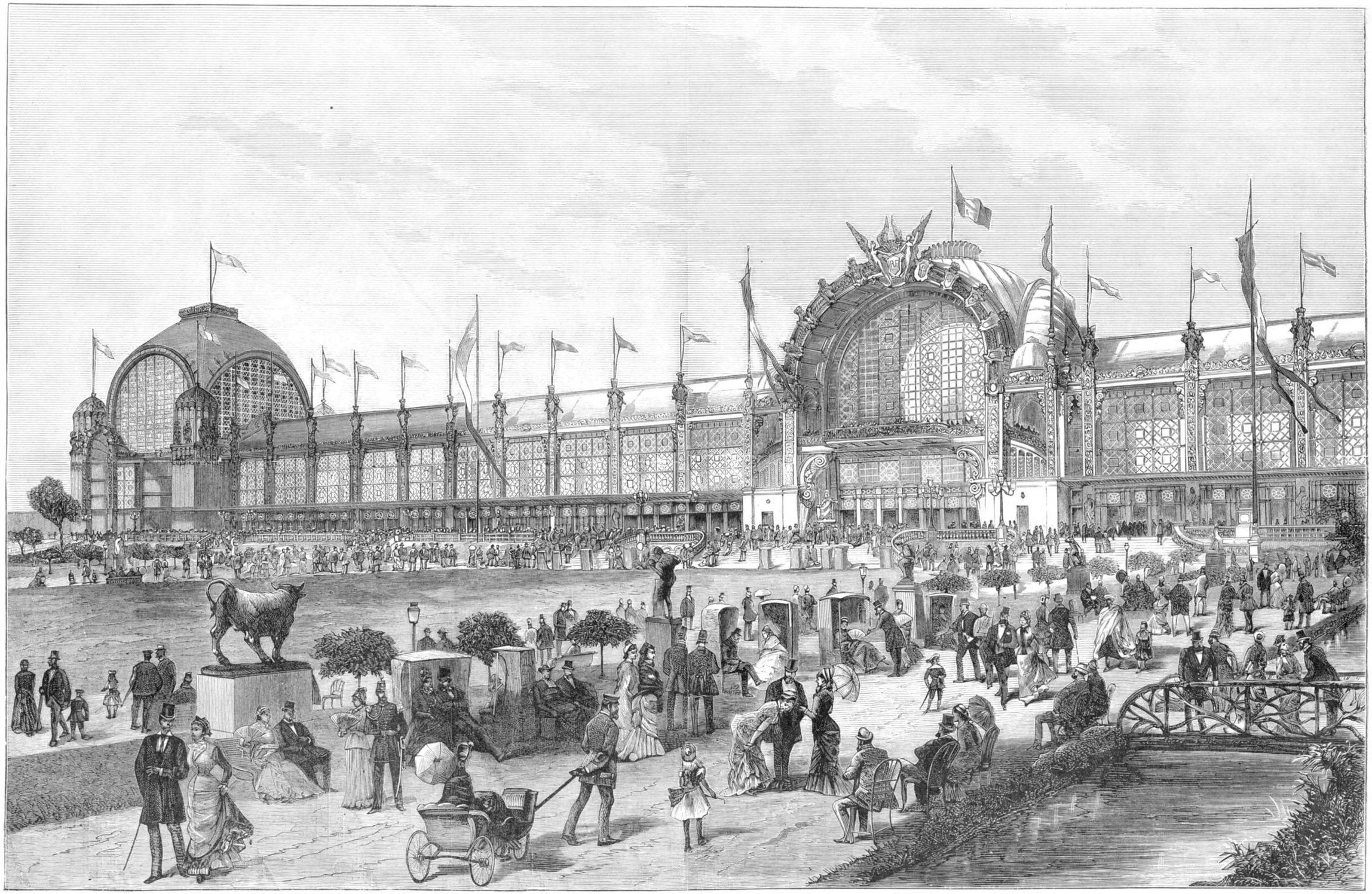

MAIN BUILDING AT THE PARIS EXHIBITION.—[See opposite page.]

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Correspondence.

American Made Goods Exhibited as European Manufactures.

To the Editor of the Scientific American:

"A good copy is better than a poor original," says the proverb. What, however, shall be said of a Continental firm which buys locks or takes samples made in New Haven, United States, and exhibits them in the Austro-Hungarian Department?

Let us examine them:

1. On the hasp and key of one are the figures "23," the private number of that particular padlock, made by Mallory, Wheeler & Co., of New Haven, Conn.

2. The stamp "2 tumblers" has been so far removed from the varnished face of the padlock that it can only be seen by glancing it in the light so as to present a certain angle. It is doubtless one of a set of samples on which the inscription, "2 tumblers," has been put with white lead, which has been removed by turpentine, but left an impression on the asphaltum varnish.

3. Another padlock has "3 in." yet visible; and a third has "in.," "20," both of the Mallory, Wheeler & Co.'s marks.

If made in Austro-Hungary, they would hardly have inscriptions in English.

4. The scutcheon of the keyhole has been ground down thin in removing the stamp of the firm.

I can only account for the substitution of American locks on one of two suppositions:

1. They could not make any so good.

2. The name of the company—Eisenwaren-industrie und Handels-actiengesellschaft, Moravia in Olmüz—was too long to go on such locks.

The American juror in this class, No. 43, Prof. William P. Blake, detected the fraud and had the award of a medal canceled. EDWARD H. KNIGHT.

Corundum.

To the Editor of the Scientific American:

My attention was called to an article in your issue of September 28, on "Corundum, its Occurrence and Distribution." Within the past two years there have been such extensive developments of this mineral in the South as to warrant the correction of a part of your article.

The deposit at Unionville, Chester Co., Pa., I understand, was abandoned for want of mineral of marketable purity. The veins at Chester are worked for emery, and it cannot be classed as corundum. The belt of this mineral is more than 250 miles long, but there are only a few places in the whole of this distance that will warrant working. The mine you mention at Corundum Hill, as opened by Col. Jenks and others, has lately been sold to the Hampden Emery Company, of Chester, Mass., who are now mining in a small way, but are making preparations for extensive work in the spring. This mine displays some very interesting features; in one part the mineral is inclosed in chlorite, ripidolite, and smaragdite, and in another portion the crystals have a gangue of albite.

Col. Jenks while working there, I am told, took out crystals of considerable value, one of which sold in Amsterdam for $7,000; and it will not be surprising to hear of more being found of equal value.

The extent of the mineral in this mine is all that the owners can desire. Heretofore the production has been so limited and uncertain that manufacturers could not rely on it; but now the outlook is very different.

In a few days an article will be given to the public on the corundum belt of the South and the uses of the mineral, also how the gems rank with the diamond. W. J. L.

New York, October, 1878.

Nitrite of Amyl in Sea Sickness.

To the Editor of the Scientific American:

Referring to an article in your paper of October 5th, on the use of nitrite of amyl in sea sickness, I have to report a number of experiments made by myself in the same direction, with results more or less gratifying in every case where the treatment was fairly tried. The use of the preparation in question to prevent or allay sea sickness was suggested to me by my friend and quondam preceptor, Professor Carl Binz, of the University of Bonn, Prussia, who claims that the nausea occasioned by the motion of a vessel at sea is due to a largely diminished supply of blood to the brain, a theory which many known facts of pathology and physiology seem to bear out.

As a majority of your readers are more interested in facts than in speculative theories of medicine, I shall pass at once to the results of my experiments. My first application of the drug was in my own case, on the occasion of a very rough passage in a small screw steamer, from Port Rush, near the Giant's Causeway, in Ireland, to Glasgow. I had prepared a mixture of nitrite of amyl and alcohol, as the inhalation of the former in a pure state is often attended by somewhat unpleasant effects, and as soon as the vessel began to roll and pitch in the seaway I found the expected opportunity to try the effects of the remedy at hand, as I am very easily made seasick. After about a dozen deep inhalations from the bottle the feeling of nausea began to pass away, and did not return for perhaps half an hour, when a repetition of the same proceeding again restored "confidence." After an hour or two I found myself no longer called upon to inhale the fumes of the nitrite, and slept the night through in comfort. A month later I came out in the National steamer Greece, from London to New York, and kept off sea sickness whenever it began to come on by inhaling as above described. Several of the other passengers were similarly benefited, but some who first tried the remedy when in the most severe agonies of the disease failed to derive any benefit, because, as I believe, they did not persist, being in that condition described as the second stage, when a man does not care whether he lives or dies, and has neither faith in anything that may be offered him nor the will to try it. (The first stage is when a man is afraid he is about to die, while in the third he is only afraid he will not die.) These experiments were made in 1876. I used about equal parts of nitrite of amyl and alcohol.

G. FARRAR PATTON, M.D.

Mississippi River Quarantine Station, October, 1878.

Patent Law.

Those who decry conferences and congresses on principle can hardly deny that the formation of clear ideas on patents and patent law has been greatly helped by the ample discussion of the subject at Vienna, and more recently at Paris. Previously to the Patent Congress at Vienna there prevailed, even among enlightened administrators, some curious ideas as to patents, nearly all of which were based upon the fundamentally erroneous proposition that man works for the benefit of the human race in general, instead of that limited portion of it beneath his own hat or his own roof tree. In the present stage of civilization, average man is not advanced sufficiently to pass laborious days and sleepless nights for the benefit of other people, and if he choose to occupy the unhappy place of an inventor it is to the end that he may make a fortune thereby—a sensible and honorable ambition. In spite of this obvious truth, there was actually, a few years ago, a band of theorists who held that the general interest of any given country or of mankind was opposed to a patent law, and that, therefore, patents should not be granted. Luckily for individuals, nations and mankind, these theoretical cosmopolitans have been brought to naught by the proof, abundantly supplied at the Philadelphia Exhibition, that the nations without patent laws invented nothing; while those which, like the United States, enjoy a patent system which, if not perfect, is at least facile, have largely contributed to the comfort and profit of the world.—*Iron.*

The Benefits of Patent Rights.

In a recent popular address, Col. Carroll D. Wright, of the Massachusetts Labor Bureau, said:

"Government has protected our inventions. To the mechanic of the United States is due the whole progress of our mechanic arts. How does the government protect these matters? By her letters patent. Now, while there are many things in our patent laws which I cannot consent to, which I cannot agree with, and which I believe from experience in that particular line needs adjustment, still the foundation idea is that the mechanic of the United States shall receive for his brain labor that monopoly to which he is entitled. The product of his brain, under the laws of this country, becomes absolute property, just the same as any other property which he might acquire by purchase; and the courts of this country protect his title to this property. To this protection of the inventive genius of her citizens is largely due the civilization which the United States has reached. It does not do, my friends, to cry out against machinery. It does not do to urge that the hard times which prevail now are the results of over-production, because overproduction is rather the result of stagnation than stagnation the result of over-production. Labor-saving machinery—the term is a misnomer—means the elevation of the mechanic, always. It means educated labor, it means raising the workingman of any country, who lives under a patent protective law, to a higher plane, to a better condition, to a nobler civilization; and therefore the government which stands in the advance, in regard to the protection of the inventive genius of mechanics, is entitled to the support and well wishes of the mechanics of that country. The government of the United States is such a government."

The Mariner's Compass.

Many people look upon the compass as an introduction of the fifteenth century, but it seems to have been well known in a primitive form in the twelfth and thirteen centuries. In one of the popular songs written in the time of King John, it is said that the sailors who go on long voyages to Friesland or to the East know their way by observing the *tramontane*, or polar star; but, when the sky is covered with clouds, and they could no longer see the stars of heaven, they had a contrivance which was this: they took a needle of iron and put it through a piece of cork, so that one end remained out, which they rubbed with the loadstone, and then they placed it in a vessel full of water, and, whichever way the end of the needle pointed, there, without any doubt, was the polar star. This formed a primitive but fairly perfect mariner's compass.

Crude Sulphur from Iron Pyrites.

A mode of treatment of iron pyrites by which one equivalent of the sulphur is obtained as sulphur, and the other in the form of sulphureted hydrogen for precipitating sulphide of copper from cupreous solutions, has just been introduced by an English inventor.

The process is to fill with pyrites a retort set in a furnace, and after heating it to a dull redness, to introduce through the charge a current of superheated steam; then the temperature of the vessel is raised, and the steam carries over in suspension about one equivalent of the sulphur. A stream of sulphureted hydrogen is also evolved, which continues throughout the operation; the relative proportions and quantities vary according to the temperature and the length of the operation. A temperature of 1,500° Fah. and upward is most favorable to the production of crude sulphur.

At a temperature of 1,400° Fah., cupreous iron pyrites, containing 47·96 per cent of sulphur, has yielded 23·7 per cent of free sulphur—practically one half of the amount originally combined in the pyrites—and nearly the whole of the remainder was evolved as sulphureted hydrogen.

To free the sulphur from arsenic that may be carried over with it, it is digested with a dilute solution of alkali or alkaline sulphide (preferably cold), and the arsenic thus rendered soluble, so that by decantation or filtration it can be removed.

In applying this treatment to pyrites containing copper, but about one half of the sulphur is distilled off, when the residue is exposed to air and moisture, whereby sulphate of copper is formed, from which metallic copper is obtained by any of the well known means.

This process seems to possess many advantages for working pyrites and poor copper sulphurets, and could, we think, be very profitably applied in many parts of the country.

New Agricultural Inventions.

Mr. Columbus M. Crossley, of Rutledge, Ga., has patented an improved Plow Stock, which is simple, light, and strong, easily made and repaired, which may be readily adjusted to work deeper or shallower in the ground, and to accommodate a taller or a shorter plowman.

An improved Plow, Harrow, and Seed Planter has been patented by Mr. Nelson M. Fowler, of Beloit, Kan. This invention consists in a novel arrangement of devices, whereby provision is made for plowing in opposite directions and turning the team without turning the machine, for changing the direction of the wheels with relation to the plows for adjusting the height of the plows, for harrowing the ground, and for planting seed.

An improved Cotton Cultivator has been patented by Mr. William W. Harvey, of Clarksville, Texas. This implement takes the place of the plow usually employed for throwing the soil from or toward the row of plants. It consists in a frame carrying two forward rollers, provided with cutting flanges for loosening and separating the soil, and two plows or scrapers for turning the soil to or from the row, according to their position.

Mr. Kenneth P. Grant, of San Buenaventura, Cal., has patented an improved Weeder, which is designed to be attached to the frame of a gang plow or cultivator, and which shall be so constructed as to cut off and destroy the weeds without turning the soil.

An improved Cultivator has been patented by Mr. Francis M. Cropp, of Platte county, Mo. This invention relates to the class of cultivators known as "wheel cultivators;" and it consists in a coupling, of new and peculiar construction, for connecting the cultivator plow beams with the axles.

An improved Sulky Plow has been patented by Mr. James E. Alexander, of Neosho, Mo. The object of this invention is to provide a simple and efficient adjustment of a sulky plow to allow for deep or shallow plowing.

Mr. Clark T. Barton, of Tuscumbia, Ala., has patented an improved Cultivator. The object of this invention is to furnish a cultivator which may be readily adjusted as a three plow or two plow cultivator, and as a two horse cultivator. It is so constructed that the plow plates may be adjusted as a shovel, a half shovel, a scraper, and a sweep, as may be required.

Hop Picking by Machinery.

We have the authority of a correspondent in the *Ironmonger* for saying that a successful hop picking machine has been employed this season in the hop growing districts of England, and will do the work of from thirty to forty expert pickers. It consists of two rubber rollers, so constructed as to draw in the branch, while two steel rollers, having an opposite action, pick the hops from it. The machine is about the size of an ordinary clothes wringer, is propelled by means of a treadle, and runs as easily as a light sewing machine. From the picker the hops run into a sack, which, when filled, is taken to the separator, which sorts the hops from all leaves or stems which may have gone into the sack, and thence to the hop house. One separator is ample for a large number of machines.

Antimony for Batteries.

Mr. R. J. Munn calls the attention of electricians, in the *Journal of the Society of Arts*, to the use of antimony as a negative element to replace carbon in some galvanic batteries where sulphuric acid is used as the exciting fluid. This metal, after a trial extending over five years, he claims, has yielded most excellent results. Among its advantages he mentions its low price, the absence of scaling and disintegration, and the fact that galvanic action begins almost immediately on immersion.

The well known defect of brittleness of antimony, when used in thin plates, is overcome by Mr. Munn by casting the metal on a core of copper or by alloying it with a small percentage of some other metal. Antimony, perhaps, does not form as perfect a negative element as carbon, but its great conductivity and its other qualities may render it valuable in many cases.

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ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, October 26, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H M.		H.M.
Venus rises	5 33 mo.	Uranus rises	1 25 mo.
Mars rises	5 22 mo.	Neptune rises	5 21 eve.
Jupiter sets	10 28 eve.	Neptune in meridian	0 09 mo.
Saturn in meridian	9 32 eve.		

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	9 41 eve.	Procyon rises	10 52 eve.
Mira (var.) in meridian	11 51 eve.	Regulus rises	1 00 mo.
Algol (var.) in meridian	0 42 mo.	Spica rises	5 37 mo.
7 stars (Pleiades) in merid.	1 22 mo.	Arcturus sets	7 01 eve.
Aldebaran rises	7 10 eve.	Antares sets	6 21 eve.
Capella in meridian	2 49 mo.	Vega sets	1 09 mo.
Rigel rises	9 16 eve.	Altair sets	11 53 eve.
Betelgeuse rises	9 02 eve.	Deneb sets	4 14 mo.
Sirius rises	11 17 eve.	Fomalhaut in meridian	8 30 eve.

REMARKS.

Neptune will be brightest October 31, being at that time 180° from the sun, and rising at sunset He has been seen at opposition with a telescope of 4-inch aperture, and a smaller instrument will undoubtedly show him, provided the observer knows just where to look. His right ascension, October 31, at midnight, is 2h. 26m. 25 sec.; declination, 12° 33′ 46″+. Jupiter will be very near the moon October 31, at setting, being a trifle north of the moon.

PENN YAN, N. Y., Saturday, November 2, 1878.

PLANETS.

	H.M.		H.M.
Venus rises	5 52 mo.	Saturn in meridian	9 03 eve.
Mars rises	5 17 mo.	Uranus rises	0 58 mo.
Jupiter sets	10 05 eve.	Neptune in meridian	11 37 eve.

FIRST MAGNITUDE STARS, ETC.

	H.M.		H.M.
Alpheratz in meridian	9 13 eve.	Procyon rises	10 25 eve.
Mira (var.) in meridian	11 23 eve.	Regulus rises	0 32 mo.
Algol (var.) in meridian	0 15 mo.	Spica rises	5 09 mo.
7 stars (Pleiades) in merid.	0 55 mo.	Arcturus sets	6 34 eve.
Aldebaran rises	6 42 eve.	Antares sets	5 54 eve.
Capella in meridian	2 22 mo.	Vega sets	0 41 mo.
Rigel rises	8 49 eve.	Altair sets	11 25 eve.
Betelgeuse rises	8 34 eve.	Deneb sets	3 47 mo.
Sirius rises	10 50 eve.	Fomalhaut in meridian	8 02 eve.

REMARKS.

Saturn will be near the moon November 5, 8h. 47m. evening, being then about 7° south of her. Monday evening the moon will be in the cluster of small stars which constitute the Western Fish.

It is now shown that Professor James C. Watson's observations of the intra-Mercurial planet agree with Mr. Lewis Swift's, of Rochester, N. Y., and also corroborate those of Dr. Lescarbault. Hence Dr. Lescarbault should be considered the discoverer of "Vulcan." Professor Watson, however, is quite confident that he has discovered another intra-Mercurial planet, which at first he supposed was the star *Zeta Cancri*. These planets probably have very eccentric orbits, and careful and persistent search with good refractors, provided with very long dew tubes, blackened inside, may result in finding them, probably less than 15° east or west of the sun. If not found thus or caught while making a transit, astronomers will have to wait until 1880 or 1882 for a solar eclipse to reveal them.

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although only approximate, they will enable the ordinary observer to find the planets.

M. M.

Positions of Planets for November, 1878.

Mercury.

Mercury rises on November 1 at 7h. 3m. A.M., and sets at 5h. 1m. P.M. On November 30 Mercury rises at 8h. 54m. A.M., and sets at 5h. 29m. P.M.

Mercury passes the meridian at 1h. 11m. P.M. on the 30th. This planet should be looked for just after sunset, south of the point of sunset; it will probably not be seen with the eye before the first week in December.

Venus.

Venus rises on November 1 at 5h. 51m. A.M., and sets at 4h. 34m. P.M. On November 30 Venus rises at 7h. 5m. A.M., and sets at 4h. 23m. P.M.

The daily path of Venus is so nearly that of the sun that it is not likely to be seen.

Mars.

Mars is very small, and although it rises before the sun and further north, it will not be likely to attract attention.

On November 1 Mars rises at 5h. 20m. A.M., and sets at 4h. 16m. P.M. On November 30 Mars rises at 5h. 6m. A.M., and sets at 3h. 11m. P.M.

Jupiter.

Jupiter is less conspicuous, but is still the most brilliant object in the evening skies. It is visible as soon as sunset, a little west of the meridian, and at an altitude of 27° or 28°.

On November 1 Jupiter rises at 43m. after noon, and sets at 10h. 5m. P.M. On November 30 Jupiter rises at 11h. 3m. A.M., and sets at 8h. 33m. P.M.

If we take the hour from 7 to 8 P.M. to look at Jupiter, the 1st satellite will be unseen because it is crossing the face of Jupiter on the 1st and 24th; it will be unseen at that time on the 2d and 25th, because it is in the shadow of Jupiter; on the 9th, because it is behind Jupiter.

The smallest satellite, the second in distance from Jupiter, will be invisible between 7 and 8 P.M. by coming in front of Jupiter on the 14th, going into Jupiter's shadow on the 23d, and going behind Jupiter on the 30th.

The largest satellite, the third in distance from Jupiter, will be crossing the planet's disk at this time, on the 17th and on the 28th will be in the shadow of the planet.

The 4th satellite will be invisible more than four hours on the 15th, as its motion is slow and it then makes a passage across the face of the planet.

Saturn.

Saturn will be in excellent position for evening observers all through November.

On November 1 Saturn rises at 3h. 20m. P.M., and sets at 2h. 55m. A.M. of the next day. On November 30 Saturn rises at 1h. 24m. P.M., and sets at 57m. after midnight.

Saturn surpasses Jupiter in interest to those who have good glasses. With even an ordinary glass, the projection of the ring on each side the ball of the planet can be seen, and the largest moon can be watched around in its orbit of 16 days' duration.

With a large telescope at this time the ring is seen as little different from a line; but the small satellites gathered around it make the whole system exceedingly interesting, and the view exquisitely beautiful.

Saturn can be known by its white light, and the fact that it is nearly on the meridian about 8 P.M., and at an elevation of about 44°.

Uranus.

On November 1 Uranus rises at 1h. 1m. A.M., and sets at 2h. 20m. P.M. On November 30 Uranus rises at 11h. 6m. P.M., and sets at 24m. after noon of next day.

Neptune.

Neptune rises on November 1 at 4h. 55m. P.M., and sets at 6h. 27m. the next day. On the 30th Neptune rises at 2h. 59m. P.M., and sets at 4h. 29m. A.M. of the next day.

Displays of Ingenuity at the Boston Mechanics' Fair.

The quality and quantity of the various products of industry being at present exhibited at the Mechanics' Exposition in Boston far exceed those of any previous exhibition in that city. Contrivances of all kinds are there; from the everlasting sewing machine, in twenty different shapes—each explained and recommended with the usual amount of volubility—to elaborate philosophical, electrical, and surveying instruments of perfect workmanship and superb finish.

Such apparatus, however, require diagrams and illustrations in order to render their distinctive features intelligible. The same may be said of other exhibits, as, for instance, the extensive display of silverware, prominent among which are some very attractive specimens by Reed & Barton, of New York city.

In this exhibition, as in all others of a similar character, there is very much which must be seen rather than written about, to be understood and appreciated. In those products, processes, and inventions that are of real practical utility there is much interest, and to a few of these reference is now made.

From the Creosote Wood Preserving Works at Elizabethport, N. J., there is a curious display of different woods that have been under water, some from New York harbor and other places, showing the rapid destruction caused by the *Teredo navalis*. The ravages caused by this and other marine or land worms and insects are astonishing. Thousands of holes are bored in all directions with geometrical accuracy, until the planking or pile is nothing else than a mass of worm cells. The destruction to wharves and ships by the *Teredo* is something enormous. It has been demonstrated, however, by forty years' experience in Europe, that timber well injected with creosote oil is absolutely protected from decay, wherever exposed, and from destruction by the *Teredo* and other worms. Creosoted ties, it is said, last in Europe from twelve to twenty-five years, and both ties and bridge timber thus preserved are in general use on most of the railways in Great Britain and on the Continent.

The specimens on exhibition show very clearly the effect of creosote on wood, and prove how effectual it is in the preservation of railroad ties, piles, timber and planking for vessels, etc.—wherever, in short, wood is liable to decay.

The process known as the "Hayford Process" is the one adopted by the company who exhibit these specimens. By this the sap and moisture contained in wood are evaporated by steam heat, and then withdrawn by powerful vacuum pumps. Wood is thus seasoned without hardening the fibers. Then hot creosote oil is admitted to the cylinder containing the wood, which, being in a vacuum, rapidly absorbs the oil. A pressure of 100 lbs. to the square inch is then applied until the wood has absorbed the requisite quantity of oil—about 8 lbs. to the cubic foot.

A large block of wood is shown that was partially creosoted, and thus fully protected from the *Teredo*, which had destroyed the rest of the block.

The Crosby Steam Gauge and Valve Company exhibit their improved steam gauges and adjustable pop safety valves. In the former the mechanism is of an uncomplicated character. The spring is hollow, and is so shaped and arranged, and the mechanism is such, that the vertical as well as the horizontal movement of its free ends is fully utilized. It thereby permits, it is claimed, the use of springs 100 per cent stronger than can be used in any other gauge, so preventing its setting under any pressure which may be indicated upon its dial. This gauge is very sensitive. There is no vibration of the pointer; no freezing. The adjustable pop safety valve is also of simple mechanism, and has few parts. The arrangement is such that it opens precisely at fixed working pressure; that it discharges all excess of steam above fixed working pressure; that it reduces the pressure rapidly upon opening; that it closes with the least possible loss of steam. One of the best features of this valve is that it never sticks on its seat.

Bean's Atmospheric Railroad Signal is in operation in the main building. The signal is worked at one side of the building, but the signal itself is placed in an elevated position on the other side. Its action is very simple. The motion of a flexible diaphragm, attached to a movable part of the railroad (as, for instance, a track instrument, drawbridge bolt, or switch lever), creates a pressure or exhaust of air in a quarter inch gas pipe connecting such lever, or other part, with the distant signal. The Old Colony and the Boston and Lowell railroads have adopted these atmospheric signals. Where the recent accident occurred on the Old Colony Railroad, we are informed, there were no signals of this description. The signal is claimed to be perfectly reliable, working automatically; every movement of the lever causes a corresponding movement of the signal. Any movement of the signal when out of sight, as at curves, or in fogs and storms, is as positively known to the switch or signal man as if in plain view. An electric connection is made between the two points, and every change of signal is announced at the station or switch post by the ringing of a bell. The electric wire runs through the pipe, which is embedded in the earth where practicable, thus being protected from storms or other disturbance. These signals have worked at distances of 1,000 to 2,000 feet reliably and efficiently during the winter and summer that they have been in operation, unaffected by atmospheric changes.

New Mechanical Inventions.

An improved Vehicle Wheel Hub has been patented by Mr. William H. Armor, of McKeesport, Pa. The object of this invention is to provide an improved construction of wheels, whereby the spokes may be inserted in the fellies and the hub without cutting the tire, and their inner ends may be kept tightly secured in the hub.

Mr. John A. Stephens, of Lecomte, La., has patented an improved Balanced Steam Valve. This invention relates to valves for steam engines which are balanced by the pressure of the steam. It is particularly intended for the throttle valves, to render the working of them easier, so that they require to operate them only power sufficient to overcome the friction of the parts.

Messrs. Hiram H. Hill and Frank Moorlen, of Augusta, Me., have patented an improved Steam Fire Engine. The object of this invention is to furnish a vertically working steam fire engine, so constructed that its action will be more steady and easy than engines constructed in the ordinary way. The improvement consists in a novel method of connecting the flywheel crank with the reciprocating pistons by means of a lever or half walking beam.

An improvement in Metallic Button Hole Stays for Boots and Shoes has been patented by Mr. Daniel Crane, of Seneca Falls, N. Y. The object of this invention is to furnish an improved device for preventing the button holes of button boots and shoes from tearing out or becoming frayed by the strain of the button hook and of the button.

Mr. James Parker, of Detroit, Mich., has patented an improved Guard for Car Axle Boxes, by which not only a considerable percentage of the oil lost with the present axle boxes is saved, but also the entrance of dust and the rapid wear of the journal and brass bearings prevented.

An improved Hose Nozzle has been patented by Mr. George F. Palmer, of Rochester, N. H. The object of this invention is to furnish, for hose of all kinds, an improved adjustable nozzle by which the quantity of water discharged may be regulated with great facility without changing the nozzles, and without impeding in the least the free passage of the water, whether a large or small stream is used.

The Stability of Modern Civilization.

In his address before the American Science Association, August 20, Professor Grote regarded the public press as at once a most efficient means for disseminating scientific knowledge and a surer basis for a permanent though ever advancing civilization than the world has ever before known.

"Those who have brought together the story of the ancient civilization of Greece have agreed with unanimity that the separation between the mass of the people and the intellectual portion became at length insurmountable, and finally led to national destruction. This makes for our view that it was to a defect or incompleteness in the machinery for the dissemination of knowledge that we must ascribe the dying out of the older states. To understand the new civilization, we must remember that it rests on a larger average intelligence, brought directly about by the discovery of the art of printing. There is then a distinct reason, a scientific ground, for the opinion that our present civilization rests upon a surer basis than did those which preceded it, and this we may safely bring forward in the cause of truth. For science is in danger always of being regarded as the enemy of the state, because it tends constantly to modify existing ideas. But if we can show the necessity for a constant modification of our ideas, arising out of our own constitution, then it may be seen to be unreasonable to defame those who follow the search for truth. And it being undoubtedly true, as Locke says, that of all the men we meet with, nine out of ten are what they are, good or evil, useful or not, by their education, we can see how wide reaching the effect of our improved basis of civilization must be upon us as a people, and how important it is to understand the real direction in which it works."

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Recent Inventions.

An improvement in Carving Forks has been patented by Mr. Daniel Williams, of West Philadelphia, Pa. The object of this invention is to provide an attachment to carving forks for releasing from the fork any substance held by it.

Mr. Asa Brooks, of Hawleyton, N. Y., has devised an improved Machine for Calcimining, Painting and Whitewashing the ceilings of rooms. It is so constructed as to do the work in a rapid and workmanlike manner.

An improved Apparatus and Process for Annealing Glass has been patented by Mr. Auguste Weyer, of New York city. The object of this invention is to anneal glass in such a manner that a greater homogeneity is imparted to the same, which enables it to resist considerable changes of temperature without being liable to crack or break.

Messrs. Geraldo A. Beeman and John T. Mason, of Comanche, Tex., have patented an improved Pump having two barrels of different diameters, the larger being subjacent to the smaller, and each provided with a valved piston, said pistons being both secured to the same piston rod. It has a weight arranged to counterbalance the added weights of the water columns above the smaller and below the larger piston.

An improved Machine for Hulling, Scouring, and Cleaning Coffee has been patented by Mr. Patrick McAuliffe, of New York city. This invention relates to an improved machine by which coffee of all grades may be hulled, scoured, and cleaned, and different kinds and grades of coffee mixed and turned out with uniform appearance, and by which no annoyance from dust is experienced as the impurities are drawn off and collected. The machine has a continuous operation, as it receives the coffee at one end and discharges it at the opposite end in a uniform and marketable condition.

Messrs. Charles F. Bailey and George F. Perrenot, of Rockport, Tex., have patented an improved Machine for Ironing Clothes, pressing seams, fluting, etc. It is simple, convenient and effective.

An improvement in Bed Bottoms has been patented by Mr. Henry S. Cate, of Millerstown, Pa. This invention relates to improvements in the bed bottom for which letters patent were granted to the same inventor April 9, 1878, and numbered 202,149. It consists of an outer frame and a number of intermediate cross shaped pieces or links, that are connected longitudinally and transversely by elastic strips with each other, with the frame, and with longitudinal rods or slats interposed between the cross pieces. The cross pieces are raised by means of wood or leather blocks placed between them and the supporting strips, so as to raise them above the slats. End cross strips of the outer frame serve as guards in case of breakage.

An improvement in Burial Caskets has been patented by Mr. William J. Noble, of New York city. The coffin has a novel catch that engages with the latch of the sliding cover. The face glass is set in a frame and arranged to slide back beneath the cover.

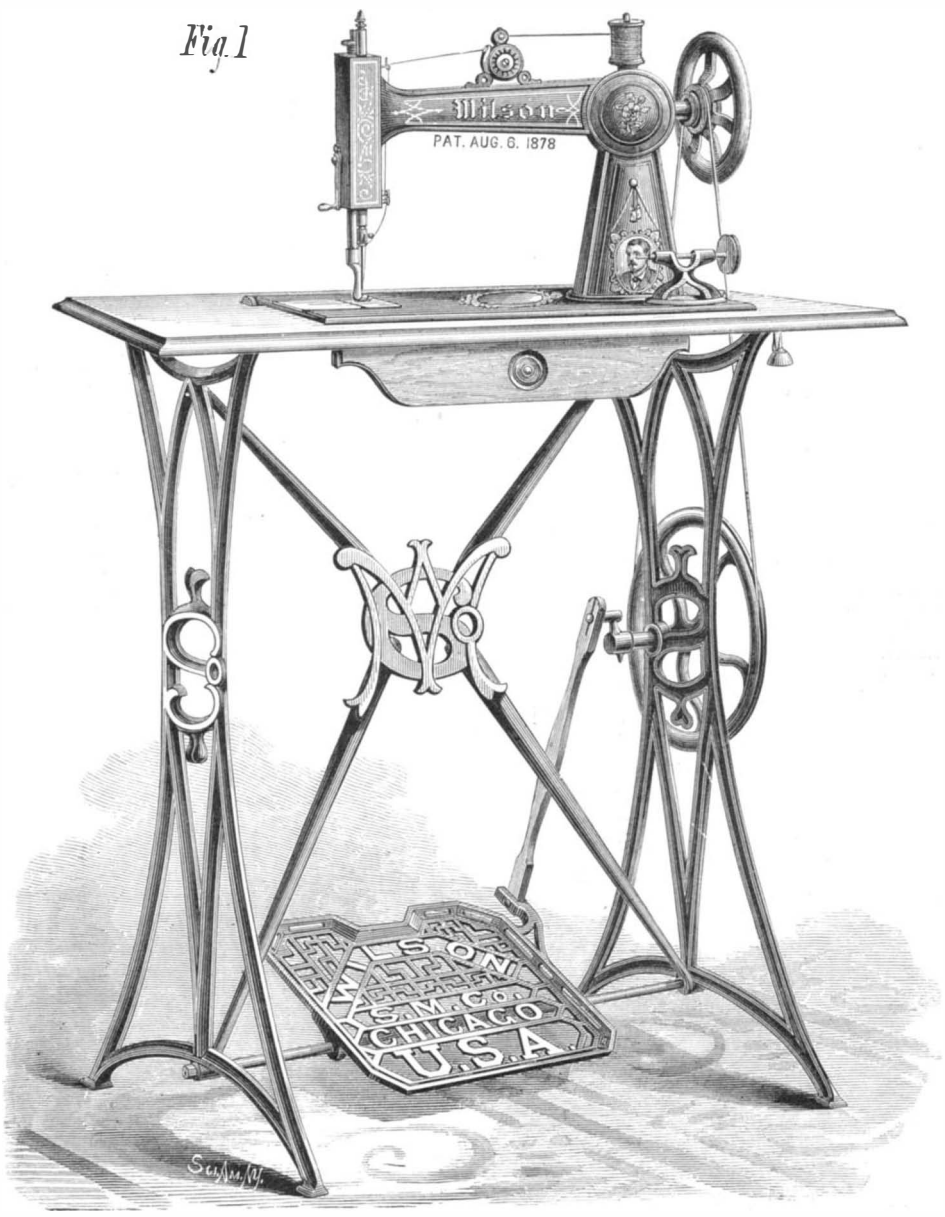
An improvement in Ash Sifters has been patented by Mr. William E. Brush, of New York city. This invention is an improvement in the class of ash sifters having a curved or sémicircular bottom, upon which they may be rocked, for the purpose of separating the ashes from the coal cinders.

New Ways to Use Iron Wanted.

In view of the plain fact that existing establishments for the production of iron and steel have a capacity far in excess of any probable demand likely to arise in the natural course of trade, the (London) *Iron* proposes a new policy for the iron trade. The business of iron masters, it argues, should be not merely to make iron, but to discover and devise new ways for using iron; and mention is made of a few instances in which a well directed effort to extend the use of iron and steel could not fail of success.

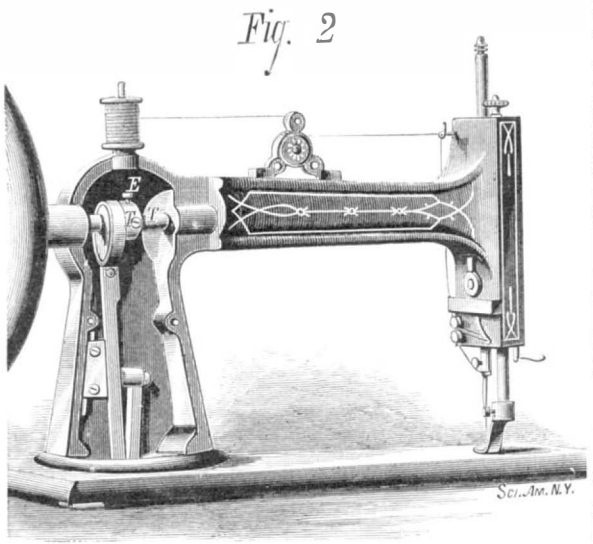
"Without dwelling on the far too limited employment of these metals in bridge and ship building purposes—for which their superiority is uncontested—one cannot fail to be struck with the great field offered by the permanent way of railways for the disposal of our surplus stocks. Mr. Wood's estimate that some forty millions of railway sleepers have to be replaced annually at a cost of over six millions sterling, is probably not far from correct. That a permanent way constructed wholly of iron or steel is at least equal, if not superior, to the existing compound system, has been demonstrated in India, Belgium, and Germany. With an economical mode of protecting the metallic sleepers from corrosion, the advantages would be still greater. Without implicitly adopting Mr. Wood's estimate that the railways would save three millions a year by the change, it cannot be doubted that it would be a highly beneficial one both for the companies and ironmasters. It is, moreover, a change which must inevitably come sooner or later, since wood is becoming yearly dearer and dearer; while there is hardly a civilized country which is not suffering—in deterioration of climate—from the destruction of timber, of which the demands of railway engineers are a prime cause. It will not be much longer endured that the preservation of a certain proportion of forest land, which is demanded alike in the interests of hygiene and agriculture, should be rendered impossible because the conservative instinct of engineers prefers continuing to use timber for purposes for which it is less well suited than iron. The enormous destruction of young trees for the supply of pit props might also be very materially lessened by the use of removable iron pillars in the many situations in which they can be successfully employed in mining.

Fig. 1



NEW WILSON SHUTTLE SEWING MACHINE.

Fig. 2



WILSON SEWING MACHINE—SIDE REMOVED.

"By the use of steel for the framework of railway carriages and trucks there would result a gain in strength, lightness, and durability; while the saving of life and property in accidents, by having cars which would present an enormous resistance to crushing, would alone justify the change. Architects are already using iron girders with some freedom, and with the experience they have thus gained of the use of metal in construction, it would require but little encouragement to induce them to adopt it much more largely in all positions where the maximum of strength with the minimum of bulk is sought. There is, however, a most singular prejudice against iron, very prevalent among architects, on the score of æsthetics. Now the truth is, that no material lends itself more readily to the most graceful and beautiful forms. Not only does its extraordinary strength enable cumbrous buttresses and bulky pillars to be dispensed with, and the widest spaces to be roofed with a single span, but, owing to the facility with which the most intricate designs may be reproduced by casting, cornice, frieze, and finial may be enriched with a luxuriance of ornament difficult of attainment by the worker in stone or wood. There is much room, too, for the increased use of iron for such purposes as fencing, the construction of outbuildings, for wheels, and telegraph posts, and a thousand minor outlets which it would be tedious to enumerate.

"While all are agreed that a vastly extended use of iron would be a matter of general advantage, are we to wait till consumers, retarded by the ponderous inertia of prejudice and ignorance, appreciate the fact in their own good time, or is it not allowable to accelerate a result so generally desirable by every legitimate means? We have had enough of masterly inactivity. The occasion is favorable for adopting a more progressive policy, which, if vigorously prosecuted, will certainly bear good fruit. Let the two bodies which represent the scientific (or technical) and the commercial interests of the iron trade appoint a Joint committee to draught a scheme for an association whose business it should be to extend the use of steel and iron. Some such body has already been formed in Belgium (though as yet it has shown few signs of life), and there is no reason why the movement should not be taken part in by the iron trade of all ironmaking countries, their interest being in this matter identical. The work of the association would consist in the collection of unimpeachable and carefully verified data as to the relative strength, durability, and cost of steel and iron as compared with wood, brick, and stone; to point out the particular directions in which the best results may be expected to follow from the substitution of the superior material for inferior ones, and to induce manufacturers generally to adopt definite sizes and patterns for the leading articles of manufacture, such as girders and columns, in lieu of the present perplexing variety, which is a relic of the days when standard gauges for screws and wire were not; to collect trustworthy information as to promising inventions tending to economy of make, and possibly to encourage judiciously the direction of invention into useful channels; above all, to give the greatest possible publicity to their recommendations and the facts on which they are founded. Such would be some of the functions that the new body could be called on to perform. By the adoption of such measures as this, we believe that such an impetus would be given to demand that the equilibrium so long destroyed would be speedily restored. The policy of *laissez-faire* has been tried; if a more vigorous policy fails of success, it will at least deserve it."

THE NEW WILSON OSCILLATING SHUTTLE SEWING MACHINE.

The sewing machine in its most perfect form is peculiarly an American manufacture. This industry, which has already attained such gigantic proportions in this country, is destined to increase, for our sewing machine manufacturers have the entire world as a market for their goods.

Among the few leading sewing machines, the Wilson as formerly constructed may undoubtedly be mentioned as one of the best. The new Wilson sewing machine, which is shown in perspective in Fig. 1, and in detail in the other engravings, and which is about to be placed upon the market, is remarkable for the peculiar combination of mechanism by which all of the movements required to make the stitch are effected by few and simple parts.

This machine is the result of years of experiment conducted by skilled workmen. We are advised that the Wilson Sewing Machine Company have a corps of ingenious and competent workmen constantly employed in improving the machine and devising new means and methods of manufacture, so that they may not only produce a machine of superior excellence, but may do it economically, so that both the manufacturer and the purchaser may share the benefits. Wherever a machine can be simplified without impairing its efficiency, it not only lessens the cost of manufacture, but it also increases its durability and facilitates its operation and management.

The Wilson Sewing Machine Company have in their new machine reduced the number of both moving and stationary

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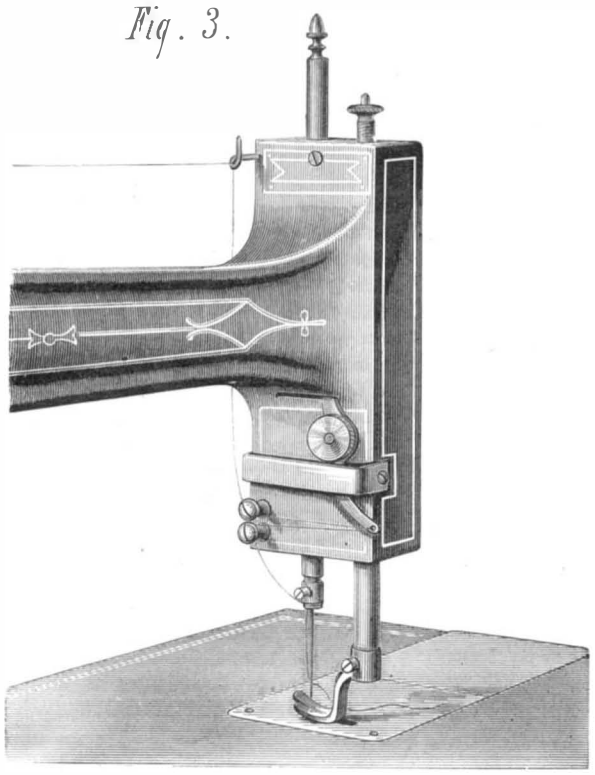
parts to a wonderfully small number, and such parts as are employed are so disposed that little power is required to overcome inertia; the machine in consequence runs lightly and evenly, and may be propelled by steam or foot power at a very high speed.

The needle is driven in such a way that the power is applied to the best advantage as it enters the fabric. The shuttle oscillates in a very short arc, and enters and passes through the thread loop within a distance which, if measured in a straight line, would be less than twice the length of the shuttle. The bobbin carried by the shuttle contains a large quantity of thread, which on its course out of the shuttle passes through a very complete tension device.

Fig. 3.



TAKE-UP.

The machine has an adjustment by which it may be made to take the tight lock stitch for heavy goods and for leather, or it may be made to take the elastic lock stitch for light goods. The stitch is tightened after the needle leaves the goods, thus permitting the use of a finer needle than is employed by sewing machines that tighten the stitch while the needle is in the goods.

The well known Wilson feed, which works on both sides of the needle, is applied to this machine. It moves the fabric after the stitch is tightened, thus relieving the thread of unnecessary friction and strain and rendering it possible to operate successfully even with a poor quality of thread.

The take-up, which is shown in Fig. 3, is of novel construction, and is capable of casting off sufficient slack thread to enable the machine to sew upon fabrics one half inch thick as well as upon the most delicate goods.

The mechanism for communicating motion from the main shaft to the oscillating shuttle shaft, and also to the rotating feed shaft, is shown in Fig. 2. It is very simple and effects the two motions without gearing or cams, and we cannot imagine how it could fail in a lifetime. The arrangement of mechanism below the bed plate for moving the shuttle and the feed bar is shown in Fig 4. In most machines this is the hiding place of intricate cams, crooked levers, and unreliable springs. Here, covered and out of the sight of the purchaser, are usually found complications which would ruin a printing press or a steam engine; but in the new Wilson machine we find so few of the parts that have been considered essential to peculiar movements of the shuttle and feed, that we are almost surprised to see the machine turn out rapidly and quietly the most regular and beautiful stitches. The feed is operated by a cam which is clearly shown in the bottom view, and the shuttle is oscillated in a circular shuttle race by means of a peculiar shuttle carrier shown in Figs. 5 and 6.

The shuttle race has a hinged and spring-acted door which holds the shuttle in the shuttle race, and also supports the spring which presses the heel of the shuttle only while its point is entering the loop. This arrangement of the spring insures the engagement of the point of the shuttle with the loop, no matter what quality of thread is used.

The shuttle, which is one of the most novel features of this machine, is shown in its place in the shuttle carrier and shuttle race in Fig. 6, and it appears in detail in Fig. 7. It has a complete tension device, carries a very large bobbin, and is very easily threaded. It is, in fact, what is known as a self-threading shuttle.

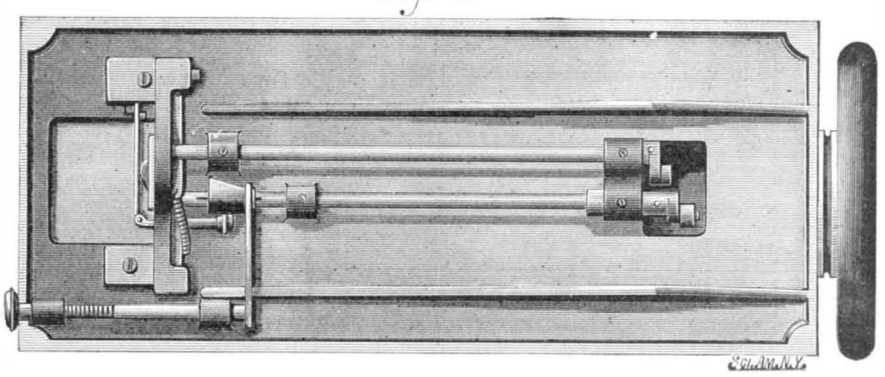
Fig. 1 gives the general appearance of this new machine. It is not only elegant in design and finish, but it is strong and of ample size for all purposes. The arm is 8½ inches long and 5½ inches high, and the belt wheels are arranged for two speeds, so that the machine may be readily adapted to heavy or light work.

The Wilson Sewing Machine Company, with the spirit which characterizes Western enterprise, have built up a large and prosperous business, which is conducted in one of the finest buildings in Chicago, and they are now reaping the benefits of placing the prices of sewing machines on a reasonable scale. It is a fact, not generally well known, that the Wilson Sewing Machine Company were the first to cut down high prices and to afford a first class machine at a fair price.

We understand that the new Wilson sewing machine, notwithstanding the improvements, will be afforded for the same prices as the old one.

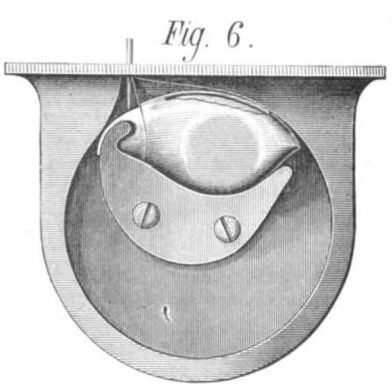
At the manufactory at Chicago the new machines are being rapidly built, so that after January 1, 1879, the market may be supplied without delay.

Fig. 4.



THE NEW WILSON SHUTTLE SEWING MACHINE.—BOTTOM VIEW.

Fig. 6.

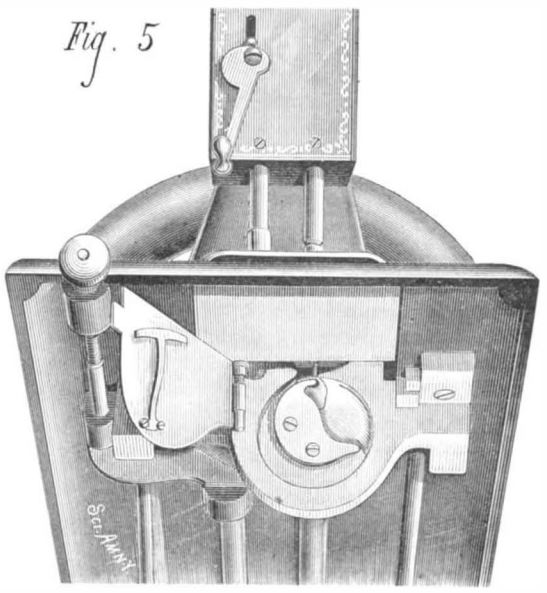


SHUTTLE AND SHUTTLE RACE.

The California Tea Fields.

The London *Grocer* sees in the Great Sacramento Valley of California the future tea field of the world. It says: "A great deal has been said and written lately on the subject of the cultivation of the tea plant. We have had glowing accounts of the wonderful success of the Scotch planters in the beautiful island of Ceylon, the extent of their gardens, and the large yield they will be capable of throwing into the European market in the course of a few years. But very few persons are aware that there is at this moment a far larger tea field than the whole island of Ceylon doubled twice over, where Chinese and Japanese are arriving by thousands to cultivate the tea plant, and where the climate is so salubrious, and the soil so rich, that in the space of twenty years from now it is confidently anticipated that they will be able to supply the whole of the New Continent, and that the Americans will not only not have to send to China for one ounce of tea, but that they will be able in the course of time to send large consignments to Europe. And this too only a fifteen day run from Liverpool! We are now speaking of the Great Sacramento Valley, California. Thirty years ago the people of California did not know the meaning of wheat--no wheat was grown there then—while to-day that valley alone is supplying Great Britain and Ireland with more than one half of the bread which they consume. The valley is 450 miles long by 50 broad; where no rain falls, it is watered by heavy fogs, which roll in from the Pacific Ocean. Along the entire stretch of this valley run the Sierra Nevada, or, as they are more commonly termed, the Californian range of mountains. Here you can get any climate, rising from perpetual summer in the valley, higher and higher, colder and colder, till you reach perpetual snow on the top. It is along the base of this range of mountains that the Chinese and Japanese are now busy cultivating the tea plant with marked success. On a visit there, some nine months ago, the writer had the pleasure of tasting the product, and found it of excellent quality. Ten years ago the tea plant was unknown in America, and was introduced by mere accident during the time of the civil war. The government at Washington finding that they could not send troops to California—they could not march an army across the Rocky Mountains, for the Indians were hostile to them—they could not send them by sea for fear of such vessels as the Alabama—they therefore, under the advice and direction of the late President Lincoln, determined to construct a railway; and for this purpose, in order to hurry on the work—for the war was not yet over, and not likely to be—they encouraged two great railway companies to construct the line. One was to start from Omaha, on the banks of the Missouri, working West; the other was to start from San Francisco, on the Pacific, working East; and both some day were to meet; and in order to expedite the work the government granted the railway companies the land through which the line went for ten square miles on each side of the track. The company that started from the Missouri engaged 30,000 Irishmen; that which started from San Francisco, not to be outdone, imported 16,000 Chinese to compete against them. In 1869, when the railway was completed, it was found that some of the Chinese had brought their favorite plant with them, and that for the last five years they had been quietly cultivating it along the base of the Sierras. Having now nothing else to do, and not wishing to return to China, the whole of the 16,000 turned their attention to this branch of industry, and at present in the State of California alone the Chinese number over 120,000. The Great Pacific Railway, which they helped to make, runs through their tea gardens, a six days' journey to New York, over a distance of 3,500 miles, and thence per quick steamer to Liverpool; or they can send it to Chicago, on the banks of Lake Michigan, thence per sailing vessels through the great lakes, down the canal from Erie to Ontario, and out through the great river St. Lawrence to all parts of the world. The plant can be gathered, packed, sent to England, sold in Mincing lane, and consumed by the general public, all within one month; and the opinion is expressed, that within our lifetime the novelty will not be 'American meat,' but in all our grocers' windows 'Californian tea,' sixpence per pound."

Fig. 5



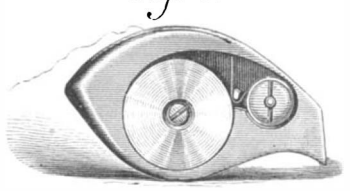
SHUTTLE RACE AND COVER.

It has been asserted that the cost of labor in this country must ever be a bar to the successful cultivation of tea. True, in China an enormous amount of hand labor is required in picking and curing the leaves; but it would not take many years of American invention to change all that. The man who makes the first successful machine for curing tea will confer a great benefit upon his countrymen, and make a good thing for himself as well.

The Golden Cup Oak.

The golden cup oak (*Q. chrysolefis*) is a puzzle to botanists; and well it may be, since it occurs as a lofty forest tree and also as a tiny bush. Dr. Kellogg, of San Francisco, pronounces the dwarfed form a distinct species; but Dr. Englemann, of St. Louis, though the difference in size is so great, believes that one species includes both extreme forms. A California botanist, Mr. J. G. Lemmon, who has lately made an extended exploration of the High Sierra back of Yosemite, sides with Dr. Englemann, and says that on the various slopes about Yosemite and elsewhere in the Sierra, he has found specimens grading all the way from a tiny prostrate bush, loaded with small, smooth cupped acorns, to the tall, majestic tree, bearing yellow golden dust-covered acorn cups two inches across.

Fig. 7.



SHUTTLE.

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Future Rifle Shooting.

In a letter criticising somewhat severely the current style of rifle practice, the celebrated off-hand marksman, Dr. W. F. Carver, insists that his style of shooting is the only one worthy to be called practical. He believes, too, that it will soon become the prevailing style. He says:

"I am willing to acknowledge that what I do may be improved upon, and give as my honest opinion that in a few short years my shooting, considered so wonderful at present, will be child's play as compared with the skill which future generations will achieve. Some people call me a wizard and others a trick shooter, while others assert that I am peculiarly gifted: but the fact is the shooting I do has come from years of hard and constant labor. The hardest life a man can possibly lead is hunting upon the plains. Twenty-seven years of steady Western life, dependent solely upon my own exertions, has taught me what I really know of rifle shooting. Was not that life of all things practical, and in nature should it not produce practical results? I have hunted for the market many years, learning nothing of trickery or deception by my calling, and what I am about to say in behalf of my shooting I know from experience to be true. Why, my style of shooting is the very first principle and really the foundation of practical rifle shooting. All men who wish to become perfect in the use of either rifle or shot gun should commence by shooting at flying objects. It is very easy to hit an object thrown into and moving in the air, provided you point your gun at it. This may seem a foolish remark, and provocative of laughter by its simplicity, yet that is all that can be said, and is the secret of hitting anything with either rifle or shot gun, but more particularly with the rifle. In shooting at moving objects with a rifle a man soon learns to take deliberate aim, and to understand perfectly well that if he does not he will surely miss. This style of shooting makes a man handle a gun with the rapidity of lightning, and in a short time—or a few years—he does it with such ease as to make many call it 'trick shooting' or 'sleight of hand,' when in reality it is nothing but a degree of perfection resulting from practice. Many think I do not take aim. In fact, this has puzzled many theorists, and has been a point of considerable discussion. Those who think I do not take aim are mistaken. Should I not take aim I never would hit an object. Let any one practice my style of shooting with a rifle for a short time, with even moderate success, and then take up a shot gun, and for the first time in his life he will discover how easy it is to hit anything with a scatter gun, and, by virtue of the nicety with which he must draw his bead with a rifle, what perfect control he has of his shot gun; then, on the other hand, how easy it is for him to hit a moving object with a rifle almost any distance. There is no question but that my style of shooting will revolutionize the whole shooting world, and a scatter gun will ultimately disappear from the arena as a real test of skill, only to be used for hunting, and in the field for market."

"Bruce," the Manchester Fire Horse.

Mr. A. Tozer, Chief Fire Station, Manchester, England, says: At the latter part of the spring of 1864, "Our Bruce" was born; he soon began to show signs of a very promising hunter, of over sixteen hands, and in due course commenced his training for the chase. At five years old he had grown to a beautiful animal, very docile and tractive—his mottled gray coat the pride of the groom and the admiration of his master. "Our Bruce," in the hunting field, once stumbled, and, in consequence, lost the confidence of his master, who disposed of him to the Manchester Carriage Company. In the early part of the year 1870 he was sold by the carriage company to the Manchester Corporation for the fire engine department, and commenced his duties on the 24th of March. His general appearance and kind, tractable, willing ways were soon noticed by the firemen, and in less than a month after he joined the brigade he was the favorite of the whole establishment, having pretty well the free run of the yard, in which he caused much diversion by his singular and funny ways. He was always full of innocent mischief, and one of his greatest delights was to chase the men about the yard. It sometimes happened that he was let out for a gambol when the children were playing. On such occasions it was most interesting to notice how careful he was in not going too near them. At other times, when the engines were in the yard, he seemed not to forget his early training as a hunter, and would amuse himself by jumping over the poles. When tired, he would lift the latch of the door and go into his stable, and just as easily, after a rest, when the stable door was closed, he would let himself out again, or knock loudly at the door to attract attention. Near the stable door there is a water tap with a revolving handle. "Our Bruce" would turn the handle with ease and help himself to a drink. It sometimes happened that a hose pipe would be attached to the tap; this would not cause him the least inconvenience; in such a case, after turning on the tap, he would lift up the end of the hose pipe with his teeth and hold the end in his mouth until he had satisfied his thirst. Many curious anecdotes could be told about our pet; how on one occasion he picked up the end of the hose and wetted one of the firemen who had offended him; how, at a fire, he would stand amid the greatest noise and excitement, with showers of sparks falling around him, and on his beautiful coat, only to be shaken off; and at other times completely enveloped in smoke; but there was no shying or fretting under fire or smoke with "Our Bruce." He seemed to know that he had brought those who would fight that ruthless tyrant fire, and he stood proud and confident that before long he would return home with the victors, when, after being refreshed and groomed, he would again be ready, always first, for the next "turn out."

For nearly six years "Our Bruce" never missed going with the first machine, at the end of which time he was, in consequence of his fine appearance, and our desire to give him a less active duty in his old age, transferred from the fire engine to the police patrol duty. We did not altogether lose our faithful animal's services, for one of his duties was to attend fires with the mounted police sergeant (whose name was also Bruce) to keep back the onlookers, which he most effectually did for nearly two years, during which time he was as great a favorite with the policemen, rarely leaving a police station without an apple, a piece of bread, or some mark of affection.

On the 7th June "Our Bruce" fell sick; the veterinary surgeon was sent for, who pronounced him suffering from inflammation of the bowels. The usual remedies were applied, and everything was done to relieve his pain and make him comfortable, but to no avail. For three days afterward he was never left for a moment, night or day, and at the end of the third day he drew his last breath, surrounded by those who loved him well, and who had been taken by him to the scene of many a hard fight. A *post mortem* examination was held the following morning to ascertain the cause of death. A stone (calculus) six inches in diameter, weighing five pounds eleven ounces, was taken from his bowels. This was, no doubt, the principal cause of the disease which led to the death of the fire horse, "Our Bruce."—*Science Gossip.*

A Nail Gun.

The *New Zealand Times* says: "One of the most simple, and at the same time most ingenious implements on view at the Wellington Industrial Exhibition, is an invention of a young man in this city, a Mr. F. Falkner. It is called a 'nail gun,' and is used for nailing down flooring boards. We have seen the implement in use, and as far as we are able to judge it is quicker in its work and insures greater cleanliness than hand nailing could do. The apparatus is not unlike a gun in shape, and is about the same length. It is kept in position with the foot and knee, and the nail to be driven is placed (point down) in an aperture at the top of the concern. It slides down to the bottom, and then the operator draws up a rod, and by one downward stroke of this the nail is cleanly driven into the boards beneath. A practiced hand, by this simple contrivance, could do the work of half a dozen men. We believe that Mr. Falkner is now improving upon his invention, and is making a 'nail gun' which will be self-feeding. We have no doubt that when the implement comes to be generally known it will be brought into general use." [An instrument of this sort has been for several years in use in this country for driving carpet tacks.—EDS.

Delicate Test for Water.

What is particularly wanted at the present day, and what has not yet been discovered, is a qualitative test which will at once determine whether or not a water is fit for dietetic purposes, and the introduction of such a reagent is the object of a paper by Mr. W. C. Stables in the *Pharmaceutical Journal.* The well known permanganate process is practically a failure, owing to the fact that potassic permanganate does not possess the power of oxidizing albuminoid matter; free ammonia is infallibly detected, while all the important "albuminoid" substances escape untouched. Convinced that potassic permanganate is the base of a very sensitive and delicate test, and that it only requires a little modification to develop it, Mr. Stables began experiments with a view of finding a reagent that would act upon the nitrogenous matter, and bring it under the influence of the potassic permanganate. For this purpose he found that potassic hydrate could not be excelled; and that 4 parts of this, with 1 part of potassic permanganate and 160 parts of freshly distilled water, made the best solution. With such a solution he has made various comparative experiments. One minim, placed in a test tube of distilled water, remains of a beautiful pink hue for several days, but the minutest trace of egg albumen in the same quantity of water will be infallibly detected. He states that he has now used this test for some time with most constant results; that is, that if, on the addition of a minim of this solution, the water in a few hours gives a brownish precipitate with loss of color, he has invariably found such water to contain an abnormal proportion of organic matter, so much so as to be injurious to health.

The Polarization of Electrodes.

At a recent meeting of the French Society of Physics, M. Lippman presented the result of his studies and experiments on the polarization of electrodes; from these he has been led to lay down the following as a law: A metal can be completely depolarized only in its own salts. For instance, a silver wire previously polarized remains polarized in solution of cobalt, copper, etc.; it can be depolarized only in a salt of silver in solution. From this law there will perhaps result a new method of chemical analysis; we may be sure, for example, that a solution contains copper if a copper wire cannot be polarized in it by the passage of a current. M. Lippman estimates that by this means the presence of $\frac{1}{50\,000}$th part of copper may be detected in a solution containing other salts, provided, of course, that the copper itself has no action on the latter.

Milk-weed Juice for Raw Surfaces.

About a year ago, Dr. G. F. Waters made the discovery (to which we have before referred) that bicarbonate of soda, if applied to a burned or scalded surface, had the property of promptly subduing the pain. To prove the truth of his discovery, he performed the bold experiment of severely scalding himself all around his wrist. The application of the soda at once relieved the pain, and if the doctor had not been careless the burn would have been cured in a week; but he unfortunately allowed his cuff button to catch and tear the blistered skin, and the edge of his cuffs to further irritate the wound by friction. The result was a suppurating wound. Studying the subject, Dr. Waters thought that possibly vegetable albumen might answer the same purpose that animal albumen is supposed to in the formation of dermal scales. He proceeded, therefore, to test his theory by removing the scab from a portion of the wound, drying the surface with blotting paper, and then at once applying the white juice of the common milk-weed (*Asclepias cornuti*). Space after space of the sore was thus treated, each portion being allowed to heal successively before the next part was tried. The time of healing varied from twenty-four to thirty-six hours, according to the depth of the sore; but in each instance new skin formed completely across. In regard to this new discovery, the doctor states that the only essential point is to dry the wounded surface gently and thoroughly with blotting paper before applying the juice of the milk-weed.

Life without Air.

The *Journal für Prakt. Chemie* gives a detailed account of experiments instituted by Professor Grunning, of Amsterdam, to settle the question as to the ability of bacteria to exist in media free from oxygen, a doctrine which has been warmly advocated by Pasteur. He made use of ferrocyanide of iron as an exceedingly delicate test for oxygen, and by the use of this reagent detected oxygen in the apparatus and media which are generally employed for cultivating micro-organisms, and which have hitherto been supposed to be free from air. The experiments consisted in inclosing in glass tubes easily decomposable substances, such as raw flesh, green peas, etc., infecting with a drop of a mixture of decayed peas and white of egg, which contains nearly all varieties of bacteria, and closing the tubes by fusion after carefully freeing entirely from oxygen. The sealed tubes were exposed to a temperature of about 100° Fah. A considerable number of such vessels have been kept two years without the contents having suffered any change, as, on opening, they were found to retain their original freshness. The result of these experiments appears to show, contrary to Pasteur's views, that by the exclusion of oxygen bacteria are completely destroyed, and putrefaction, being arrested, does not continue afterward on the admission of filtered air free from bacteria.

Cadaver-Poison of the Australian Natives.

According to Taplin, the inhabitants of the lower Murray district of Australia, who are comprised under the name of Narrinjeris, make use of a most destructive and terrible poison for killing their enemies, namely, the specific animal poison developed in human corpses. The instrument used for inoculating an enemy with it is called *nieljeri.* The natives state that they obtained the knowledge of this poison from the inhabitants along the upper Murray. It has at present become a most destructive weapon in the hands of the natives, who adopted it with so much the more eagerness as their former belief in charms is gradually dying out. The practice of the nieljeri is very much facilitated by the fact that the natives do not bury their dead, but preserve them above ground. Into such a corpse the point of a spear, consisting of a sharp-pointed piece of human bone, six to eight inches long, is inserted. Then a bunch of hairs or feathers is saturated with the fat of the decomposing body, and tied about the pointed bone. This apparatus is the nieljeri. With it the murderer stealthily approaches his victim, slightly scratches the skin with the sharp poisoned point, and, if undetected—as often happens in consequence of the narcotic sleep of the natives after one of their gigantic meals—he steals away unsuspected. Soon the terrible effects of the cadaveric poisoning make their appearance, and the person generally dies under the most excruciating pains.

Milk Cure for Lead Colic.

A remarkable case is given in the *Journal de Médecine* of the effect of the habitual use of milk in white lead works. In some French lead mills it was observed that in a large working population two men who drank much milk daily were not affected by lead. On the general use of milk throughout the works, the colic entirely vanished. Each operative was given enough extra pay to buy a quart of milk a day. From 1868 to 1871 no cases of colic had occurred.

We had not before known of this remedy, but, some years since, on questioning certain workmen who were engaged in the manufacture of red lead or minium, we learned that each one secured immunity from colic by drinking a pint of olive oil per diem.

FRENCH directions for the use of a domestic dye:

To dye by yourself without preparation.

This is an English translation of a French circular given to people passing in the Exhibition.

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SERPULAS, OR SEA WORMS.

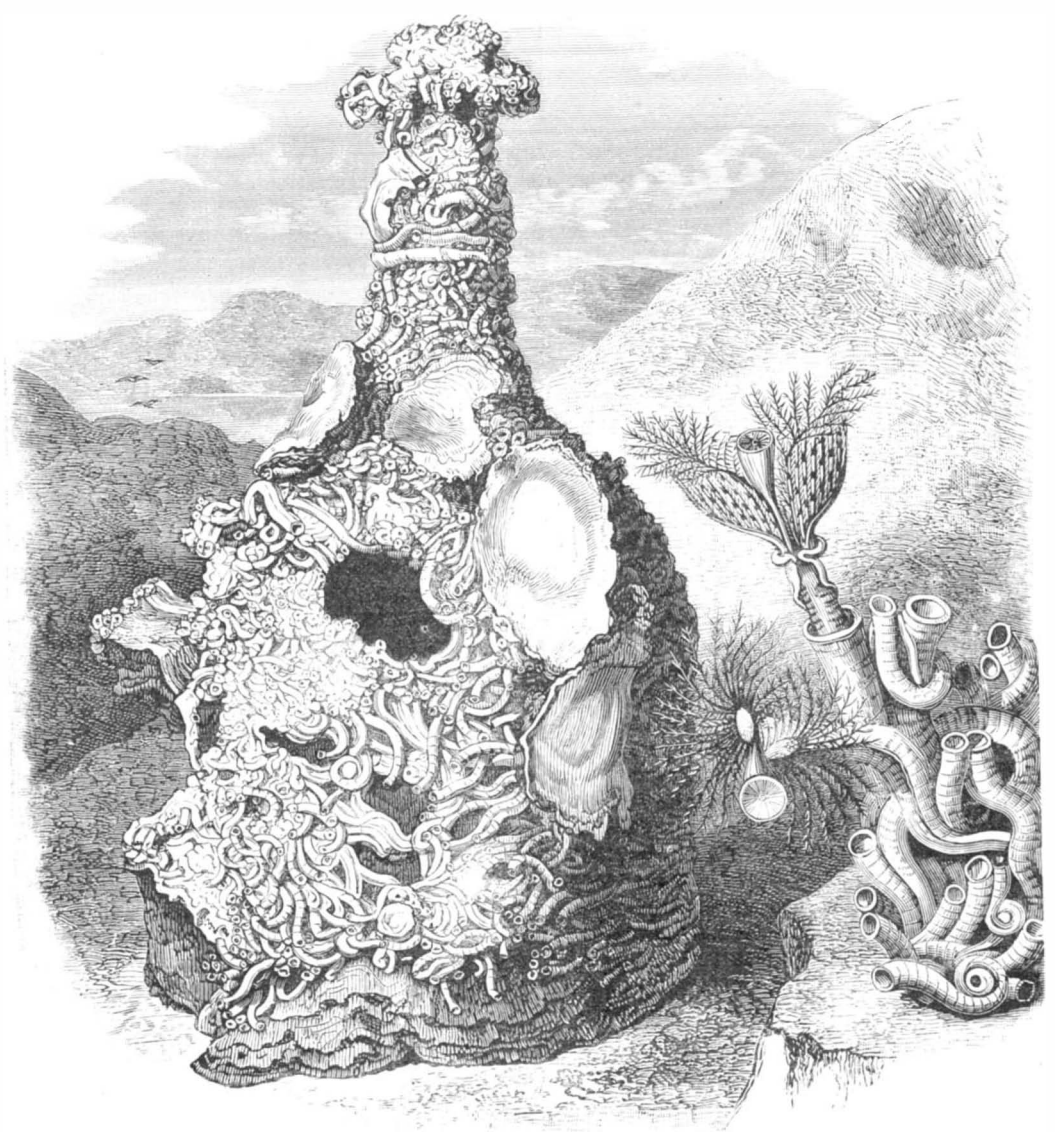
The rambler along the sea shore will not unfrequently meet with shells, stones, and other objects that have long been immersed in the waters of the ocean, more or less incrusted with masses of white, calcareous tubes, which, from their writhing forms, at once suggest to his mind the idea of worms. The old bottle, covered with these familiar objects, shown in the annexed illustration, will perhaps recall a forgotten subject to the mind of many a reader. These elongated, variously twisted tubes, popularly supposed to be "petrified worms," constitute the dwelling places of certain small marine worms called *Serpulæ*. In the animal kingdom these little creatures have their place in the lowest class of Articulates. This class, the *Annelida*, embraces an extensive series of animals usually grouped together under the common name of "worms," and comprehends four orders, as types of which we may take, for instance, the (1) sea centipede, (2) the leech, (3) the earth worm, and (4) the marine worm (*serpula*). This class is remarkable as being the only section of invertebrate animals which possess red blood. The worms belonging to three of these orders are erratic, but the fourth (whose type is the *serpula*) includes creatures which inhabit a fixed and permanent residence that serves to inclose and protect them from external injury. This is generally an elongated tube, varying in texture in different species. Sometimes it is formed by agglutinating foreign substances, such as grains of sand, small shells, etc., by means of a secretion which exudes from the surface of the body and hardens into a tough membranous substance, as in the case of the *Terebe'la*. In other cases, as in *Serpula contortuplicata* (the species shown in the engraving), the tube is homogeneous in texture, formed of calcareous matter, and apparently secreted in the same manner; for this reason the tube keeps increasing in length and diameter as long as its inhabitant continues to grow, the formation of this protecting sheath being the progressive work of the entire life of the animal. The elongated body of these worms is divided into numerous rings, and its anterior portion is spread out in the form of a disk armed on each side with bundles of coarse hairs; in this disk is the mouth opening.

From the sides of the mouth arise the fan-shaped respiratory tufts (shown in the enlarged figures to the right of the illustration), forming most elegant arborescent appendages of a beautiful red color, mixed with yellow and violet, and exhibiting when expanded a spectacle of great beauty. In some species (as in the one illustrated herewith) there is a remarkable provision made for closing the tube when the worm retires within its cavity.

On each side of the mouth of the worm is a fleshy filament resembling a tentacle; but one of these, sometimes the right, sometimes the left, is found to be considerably prolonged, and expanded into a funnel-shaped operculum or lid, which accurately fits the orifice of the tube, and thus forms a sort of door, well adapted to prevent intrusion or annoyance from external enemies.

It has been shown by experiment that if these little creatures be taken from their shell, or the latter be destroyed, they make no attempt to form another, having lost either the faculty or the instinct of doing so.

As it is in the nature of serpulas to live in numerous colonies, we usually find their tubes agglomerated into compact masses on all kinds of submarine objects, about which they bend and twist themselves in all sorts of shapes. The curious bottle, the shape of which is so well preserved through the mass of serpulas and oyster shells which incrust it, is among the specimens in the Museum of Natural History, at Paris.



SEA WORMS OR SERPULAS INCRUSTING AN OLD BOTTLE.

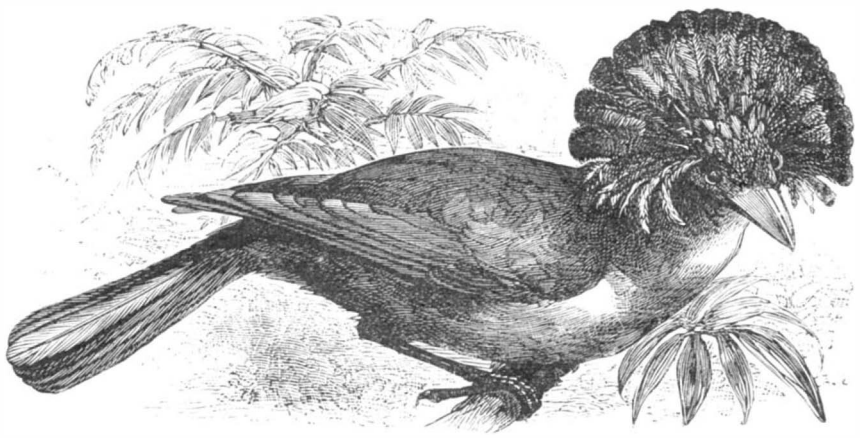
[The figures to the right show the animals enlarged.]

KING TODY.

The singular and beautiful bird which is known by the name of King Tody, or Royal Great Crest, is a native of Brazil, and may challenge competition with many of the flycatchers for elegance of form and beauty of coloring.

It is a very rare bird, to all appearance but little known in its native land. This species is chiefly remarkable for its splendid crest, which is capable of being lowered upon the neck, or raised almost perpendicularly, in which latter position it assumes a spreading and rounded form, like an open fan.

The feathers of the crest are long and slender, and spoon-shaped at their extremities. Each feather is bright chestnut-red for the greater part of its length, a narrow stripe of rich orange succeeds, and the tip is velvet-black, encircled by a band of steel blue. As may be supposed, the effect of its spread crest is remarkably fine and striking. The upper parts of the body are dark chestnut brown, rather deeper on the quill feathers of the wings. The throat, chest, and abdomen are pale fawn, warming towards chestnut on the central line. The total length of this bird is six inches and a half. We take our illustration from Wood's "Natural History."



KING TODY.

The Formation of Quartz.

A San Francisco engineer and metallurgist, J. Mosheimer, writes to the London *Mining Journal* as follows:

A further proof of the formation of quartz from aqueous solutions has presented itself in a steam boiler in use in one of the Nevada mines. A boiler of four feet in diameter and provided with five flues had been in use for some years; but little attention had been paid to cleaning it or blowing it off, as it is called, and a sediment accumulated until it reached the first two flues. The whole of the interior was heavily incrusted, and as it conducted too little heat the boiler had to be replaced by a new one. After cutting the former to pieces my informant, Mr. E. Watkins, M. E., found a heavy incrustation all around the inside. At the bottom of the boiler a soft sediment was found, which was overlaid by another hard crust. The flues were incrusted on top with silicate of lime, and had at the bottom a coating of solid transparent crystals of quartz; the crystals were of rhomboidal shape, about one half inch in length, and as perfect as any other natural quartz crystals. The formation of quartz crystals of considerable size in boiling water in but a few years leads me to the belief that the large quantities of granulated quartz which were found in early days in the burning Moscow mine, on the Comstock lode, were of the same origin.

Quartz may thus be decomposed and made soluble by the action of steam in combination with an alkali, and then used as soluble silicate.

Fragarine.

Dr. T. L. Phipson finds in the root of the strawberry several substances closely allied to some which are contained in the cinchona barks. One of these is a compound very similar to quinovine; another, which he calls fragarianine, from the botanical name of the strawberry is a kind of tannin closely allied to quinotannic acid, but, instead of yielding cinchona red like the latter, it yields a somewhat similar substance called fragarine. To obtain the latter about 50 grms. of the strawberry root, in thin slices, are left for forty-eight hours in a stoppered bottle, with water acidulated with about 5 per cent of hydrochloric acid. The solution filtered off is of a pale golden-yellow color; it is strongly acidified by addition of more hydrochloric acid and boiled for an hour or two. As the temperature rises towards the boiling point the pale yellow liquid becomes darker and redder, and finally takes a splendid orange-red color. On boiling it becomes cloudy, and after some time fragarine is abundantly precipitated in flocks of a reddish-brown color. After allowing the liquid to become quite cold it is filtered, and the new substance collected is washed with cold water. The filtered liquid contains glucose.

Fragarine thus obtained has the following properties: It is an amorphous reddish brown powder, highly electrical by friction, soluble to some extent in water, alcohol, and ether, dissolving in potash with a fine reddish purple color. It dissolves in concentrated sulphuric acid, and forms a conjugated acid the solution of which is brownish-purple. Boiling hydrochloric acid does not affect it. Treated with nitric acid it forms a brilliant yellow nitro-compound, different from picric acid, yielding no picramic acid when reduced by sulphide of ammonium. Chlorate of potash and hydrochloric acid mixture yields a bright yellow chlorine compound, insoluble in water, decomposed by ammonia.

Heated in a tube fragarine yields water, is decomposed without fusion, depositing much carbon, and producing a white volatile substance which condenses in the tube and is soluble in water; the solution produces a green color with salts of iron; it is probably pyrocatechin. Melting hydrate of potash decomposes fragarine with production of dark brown substances and a little protocatechuic acid, which can be isolated by ether from the acidulated solution of the products of this reaction, and also colors iron salts green.

While fragarine is being produced by boiling with hydrochloric acid as above, there is diffused through the laboratory a very agreeable odor of essence of cedar. When the same experiment is made with an acid decoction of red and yellow cinchona barks (obtained in the cold) there is produced an odor of heated spermaceti. It is curious that both essence of cedar and cetene of spermaceti contain 32 equivalents of carbon. Instead of giving a dirty green color with potash, as cinchona red does, fragarine dissolves with a reddish or brownish purple color. This is the best way of distinguishing between these two substances.

The Stiffening of Plant Stalks.

The presence of silica in the stalks of grain has long been claimed as a proof of design in the structure of such stalks. The soft fiber of the growing grain would not be stiff enough to support the head; accordingly a stiffening of silica was added to the outside. Chemical analysis has shown, however, that at the time when the stalk most needs stiffening it does

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not contain a hundredth part of silica. Professor Caldwell of Cornell University derides the idea that so small a percentage of a very brittle substance like silica could add toughness to a stalk; and shows that the results of experiments demonstrate the absurdity of the idea.

He says, in the *Tribune*, that, though nearly three fourths of the ash of wheat stalks, for example, is silica, it is found that "this apparently large proportion of silica is not in the stem itself, but mostly in the leaf, including that part of it which forms a sheath about the stem; this loosely attached sheath can evidently bear no part in supporting the head. Secondly, it has been repeatedly shown that perfect plants of wheat, rye, oats, or Indian corn, with stems of all the usual strength, can be grown in media containing no silica, and that there was none of the substance, or merely a trace of it, in the ash of the plant—only what it took up from the small quantity that was dissolved out of the walls of the glass vessel in which the plants were raised.

"Thirdly, it is well established, by these and other researches, that the strength of the stalk does not depend on any of the ingredients of its ash, or of the mineral matters that it takes from the soil, and that the weakness of the stalk that causes the grain to lodge is not the result of any peculiarity in its chemical composition. This weakness is rather the consequence of an abnormal mode of growth of the cells in the lower part of the stalk, where strength is most needed, these lower internodes, by reason of a deficient exposure to light, stretch themselves out and grow to an unusual length, and the cell walls are found to be unusually thin, and are therefore weak. This weakened condition of the stalk has been produced artificially by surrounding it with a tube of clay or other opaque material; and on comparing a stalk thus grown with some stalks of lodged wheat, the same unusual spindling form and thinness of cell walls were to be seen in both. Fourthly, Velter tested the comparative strength of small bundles of wheat stalks, from a plat that had been thinned out so as to admit light and air freely, of some wheat that grew thickly together, and of some that had been manured with a soluble silica compound in addition to its regular food: the first was the strongest, and the last the weakest of the three."

The Contortion of Rocks from Heat Mechanically Generated.

M. Daubrée, the eminent director of the School of Mines of Paris, in a paper read before the French Association, in August, says that one of the most remarkable characters of the rocks which have undergone mineralogical transformations, comprised under the name of "metamorphism," is that the rocks thus transformed are often associated, occupying together considerable territory, while other regions, still more extensive, do not present like modifications. These transformations, in all probability, have taken place under the influence of an elevated temperature; and while they are partially due to heat from the depths of the earth, there is a cause for them which is more immediate and more general, that is, heat produced by mechanical actions, that have left their traces in the bendings and foldings of the strata. M. Daubrée, after a series of experiments on the heat produced in rocks by interior movements, draws the following conclusions: (1.) The rocks were already in a solid state at the period when they followed the action which contorted them; (2.) Many of these rocks during these movements acquired a laminated structure; (3.) Certain effects of regional metamorphism may be derived simply from the heat which has been developed in the rocks by mechanical action; (4.) Fossils have been destroyed by trituration in the interior movements of such rocks as have become changed in texture or assumed a crystalline state.

"Finally," says M. Daubrée, "in rock masses where metamorphism has been developed on a great scale, and far from any eruptive rock, the heat which has presided over the transformation of the rocks, and the appearance of new species of minerals, may have been caused by the very mechanical actions which these rocks underwent."

Balata Gum.

From an article written by Dr. W. Riegler, published in the *Wochenschrift des Niederoest. Gewerbe-Vereins*, we gather the following information regarding this new article of commerce, which promises to become of considerable importance in view of the ever-increasing demand for India rubber, and the rapidity with which the trees that produce both the latter and gutta percha are necessarily being destroyed. Balata is a product of the *Mimusops balata* (Nat. ord. *Sapotaceæ*), a tree of large dimensions growing on the banks of the Orinoco and Amazon, in South America. The milky juice is procured, like caoutchouc, by incision of the trunk. It dries very quickly on exposure to the air if the atmosphere is dry, and can be readily moulded into shape by first being softened in water. This gum, in its general properties, appears to be of a character intermediate between India rubber and gutta percha, possessing the elasticity of the one and the ductility of the other, without the intractability of India rubber or the brittleness of gutta percha. It is tasteless; heated, it diffuses an agreeable odor, and can be cut the same as gutta percha. Heated to a temperature of 120° Fah., it becomes soft and capable of being welded. Its melting point is 270° Fah., a temperature much higher than that necessary to melt gutta percha. It is entirely soluble, cold, in benzole and bisulphide of carbon. Under the action of heat it is likewise soluble in turpentine; in anhydrous alcohol and ether, however, it is but partially so. It is acted upon by neither the caustic alkalies nor concentrated hydrochloric acid; but, like gutta percha, it is attacked by concentrated sulphuric and nitric acids. Subjected to friction it becomes very electrical. It is probable that it will be extensively employed as an insulating medium for telegraphic purposes, for which its superiority over gutta percha has already been proved by trial. In balata, says Dr. Riegler, we have an article that gives promise of being of the highest utility; not so much on account of its possessing new properties, as because it is a new member of a group of the useful elastic gums; and which, occupying, as before remarked, an intermediate place between caoutchouc and gutta percha, may become under certain circumstances more valuable than either of these substances.

The Torrey Botanical Club.

At the regular meeting of the Torrey Botanical Club, held at Columbia College, on Tuesday, October 8, the president, Dr. Geo. Thurber, exhibited a number of interesting American and foreign plants of his own cultivating. Among the latter were *Andropogon schœnanthus*, or lemon grass, a species of grass which grows abundantly in India, Ceylon, and the Moluccas, and from the fragrant leaves of which is distilled an essential oil largely used in perfumery; and also an ornamental striped grass from Japan (*Ularia Japonica*), one of the varieties of which presented a curious example of cross variegation.

Mr. Leggett called attention to the fact that *Monotropa hypopitys* exhibited two very different forms; the one occurring in the early part of the season (June) being pale yellowish and odorless, and the other, appearing in August, being reddish and quite fragrant. He asked whether these two diverse forms had been properly investigated, and whether it might not be possible that they were different species.

The vice-president, Mr. A. Brown, made a valuable contribution to our present knowledge of the flora of this vicinity in the form of a list, accompanied by specimens, of over fifty species of plants that have not been hitherto reported. Most of these plants were found growing on a vacant lot near the depot of the New Jersey Central Railroad, at Jersey City, where they had apparently been established for years. Twenty-two of these plants are not recorded in our manuals of botany, and are from foreign countries, probably having been introduced from the ballast of ships. Of the remainder, many are from the South and West. One specimen, apparently an exotic composite, has not yet been determined. The list was placed in the hands of the editor of the *Bulletin* for publication.

One of the members reported plum trees in flower at the present time on Staten Island, and exhibited specimens. The president remarked that such an occurrence was not uncommon, especially in a certain kind of harvest apple. The late fall-flowering of the horse-chestnut in the city parks has been noted by the members for several years past, and many times reported at the meetings of the club.

In an ensuing discussion on some of the *Nymphæaceæ*, the question was asked, What is the use of the mucilage investing the stems of *Brasenia peltata*, in the economy of the plant? The president suggested that this was an interesting subject for investigation, and suggested that the members look into the matter and report at the next monthly meeting.

Immense Labor Performed by Bees.

Nectar is the term applied by botanists to the sweet tasting fluid which is secreted within the cups of flowers; and the object gained to plants by its presence is that insects, induced to visit flowers for its sake, are useful to the plants by effecting a cross fertilization, an additional amount of vigor being thus conferred on the seeds which subsequently result, in contrast with the evil effects produced by continuous "breeding in and in." The formation of nectar is observed to take place most freely in hot weather, and to be prevented by cold or wet. So great economy is exercised by the plant that it is only formed at the time when insects' visits would be beneficial, that is, when the anthers are ripe and shedding their pollen, or when the stigma is mature and ready to receive pollen. By biologists the visits of bees, butterflies, and other insects are believed to have exercised in past time an important influence in modifying the size, shape, color, etc., of flowers. Nectar is of course the source whence bees derive honey, but it also affords food to many kinds of insects which do not possess the same habit as the former of storing it up. Professor Alexander S. Wilson, of Glasgow, has recently investigated the amounts of sugar contained in the nectar of various flowers, and laid the results of his labors before the British Association. He extracted the nectar with water, and determined the sugar before and after inversion by means of Fehling's copper solution. From his table of analyses, which for our present purposes it is unnecessary to reproduce here, we select clover as an example. He found that, approximately, 100 heads of red clover yield 0·8 gramme of sugar, or 125 give 1 gramme (16 grains), or 125,000 1 kilo (2⅛ lbs.) of sugar; and as each head contains about 60 florets (125,000×60), 7,500,000 distinct flower tubes must be sucked in order to obtain 2⅛ lbs. of sugar. Now as honey, roughly, may be said to contain 75 per cent sugar, we have 1 kilogramme (2⅛ lbs.) equivalent to 5,600,000 flowers in round numbers, or, say, two and a half millions of visits for one pound of honey. This shows what an amazing amount of labor the bees must perform, for their industry would thus appear to be indispensable to their very existence.

The Big Trees of California.

Professor W. H. Brewer, of Yale College, an eminent authority on matters pertaining to the botany of California, writes to the *New England Journal of Education* to correct some errors made by a correspondent of that paper in regard to the "Big Trees of California"—errors which are constantly creeping into the papers, although they have often been refuted. He says:

The first error relates to their height, the second to their age.

If only the truth be told, they still remain the grandest trees on earth, and one of the wonders of the world. Some of the Australian *Eucalyptus* trees exceed them in the matter of height, yet, take them all in all and as they are, the giant *Sequoias* are the greater. Your correspondent tells of "The Father of the Forest" being "about four hundred and fifty feet high when in his glory," as if this was a proved fact rather than a vague guess. The fact is that no one knows how high it was, for, when the grove was first discovered by white men, the prostrate tree was already partly rotten and the whole top burned away; and accounts published twenty-four years ago speak of the tree as perhaps over 400 feet high when living.

The State Geological Survey carefully measured all the higher standing trees in this grove, in the Mariposa grove, and some of the trees in the other groves, and published the result years ago. In the Calaveras grove there were then 27 trees of 250 or more feet, four of which were 300 or more feet, the highest being 325 feet. Over 300 trees were measured in the Mariposa grove, the tallest of which was 272 feet. The only other tree I have seen which rivals "The Father of the Forest" in diameter is in the King's river grove, and was less than 300 feet high. There is no evidence that "The Father of the Forest" (or any other *Sequoia*) ever reached 350 feet, and what its height actually was can never be known.

Next as to the age. The first extended description, published in Europe twenty-five years ago, "estimated" the age at several thousand years, and gave wings to the imagination as to the events in the world's history which the old trees had seen in their life-time. This error has been refuted from year to year, for I know not how long, for every scientific investigation has shown its fallacy; but the first story was so well told, and seemed so marvelous, that it is repeated by the majority of "correspondents" in some form, and I am sorry to say that clergymen and teachers are not the least common offenders. It is so much easier to repeat a startling story than it is to test its accuracy, that it is probable future generations of correspondents in 1978 will continue to tell how large this or that tree was "when Paris carried Helen from the walls of Troy." And so your correspondent speaks of one still standing as "a tree that began its growth long before David reigned in Israel!"

We know the actual age of only one of the larger trees of the Calaveras grove, and that is the tree your correspondent tells us of as having been felled in 1853. That tree was sound to its center, and we know its age to within a very few years, and it began its growth more than twenty-five hundred years after David died. It is possible that some of the oldest trees of this species may have begun their growth over 2,000 years ago, but not at all probable that any reached back to within a thousand years of the time of David.

The Use of Snails in Medicine.

While snails are no longer an article of materia medica, says the *Pharmaceutical Journal*, they are occasionally used in England, boiled in milk, as a popular remedy in diseases of the chest, simply, perhaps, for the reason that their mucilaginous properties are looked upon as likely to prove beneficial. But although snail soup is usually suggestive of the ludicrous to the English mind, M. Baron Barthélemy maintains that snails are capable of rendering valuable service in most chest complaints, bronchitis, asthma, etc., because, in his words, they contain "animalized sulphur, a little phosphate of lime, and especially carbonate, animalized, in solution, and in a nascent state in their mucilage." The preparations he exhibits, at the Paris Exhibition, are "Snail Sirup," "Snail Bonbons," and "Helicine," as mucilage and powder. For these the edible snail (*Helix pomatia*) is used, collected in the vineyards in the south of France (preferably in the months of August and September), and carefully preserved and fed during the winter. M. Barthélemy lays great stress on this feeding, and attributes the reason that these snails are not more generally used as an article of diet to the fact that their flavor is only properly developed where they obtain suitable food, as, for instance, in the vineyards of the south of France and Italy. However this may be, and whatever may be thought of the chemistry of the subject, it is certainly the fact that when this very mollusk was a tidbit of the Roman epicure, it was, before being cooked, fattened in the *cochlearia* by means of a paste composed of meal and wine.

M. BUCHNER, a French scientist, has discovered that a single drop of alcoholic extract of Campeachy wood, placed upon pure flour or bread, will cause a brownish yellow stain. If the flour contains alum, in the proportion of one or two per cent, the color will turn to a grayish blue or violet gray. With one half per cent of alum the tint is reddish yellow, with a border of gray blue, and small blue spots can be discovered by examining it with a lens. One fourth per cent of alum is the limit of reaction, when the blue border disappears, although the small spots are faintly discernible.

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AMERICAN INSTITUTE OF THE CITY OF NEW YORK,
New York, October 14, 1878.

R. J. CHARD, ESQ.,
134 Maiden Lane, New York:

Dear Sir:—For your exhibit at Forty-sixth Exhibition, of Lubricating Oils, "The Medal of Superiority" has been awarded, based upon practical test made by Prof. R. H. Thurston, of Stevens Institute. The medal will be prepared, and you will be notified when ready for delivery.

Yours,
CHAS. WAGER HULL,
General Superintendent.

TO INVENTORS.

An experience of more than thirty years, and the preparation of not less than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. In addition to our facilities for preparing drawings and specifications quickly, the applicant can rest assured that his case will be filed in the Patent Office without delay. Every application, in which the fees have been paid, is sent complete—including the model—to the Patent Office the same day the papers are signed at our office, or received by mail, so there is no delay in filing the case, a complaint we often hear from other sources. Another advantage to the inventor in securing his patent through the Scientific American Patent Agency, it insures a special notice of the invention in the SCIENTIFIC AMERICAN, which publication often opens negotiations for the sale of the patent or manufacture of the article. A synopsis of the patent laws in foreign countries may be found on another page, and persons contemplating the securing of patents abroad are invited to write to this office for prices, which have been reduced in accordance with the times, and our perfected facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Vertical Engines, 10 to 15 H. P., thoroughly well made. John Hartrick & Co., 47 Gold street, New York.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister, Mf. Optician, 49 Nassau St., N.Y.

The Asbestos Roofing is the only reliable substitute for tin, it costs only about one half as much, is fully as durable, and can be easily applied by any one. H. W. Johns Manufacturing Co. are the sole manufacturers.

Northrop's Sheet Iron Roofing makes most durable fireproof roof. Used on all kinds of buildings. Send for circular and prices. Northrop & Co., Pittsburgh, Pa.

Engines, ½ to 5 H. P. Geo. F. Shedd, Waltham, Mass.

Mail Bag Locks and Fastenings. New Patent. Valuable. Address D. J. Miller, Santa Fe, New Mexico.

Wanted.—Second-hand 1 to 3 H. P. Boiler and Engine. Address H. A. Johnson, Medina, N. Y.

For Sale Cheap.—One Horizontal Engine, 18 in. x 36 in.; one Plant Hoisting Engine, four drums; and two 25 H. P. Vertical Engines. Apply to Wm. Taylor & Sons, 25 Adams St., Brooklyn, N. Y.

New Hand, Foot, or Steam Band Saws that will cut 7½ in. thick; price $35. G. W. Baker, Wilmington, Del.

Giant Car Pusher. Tackle Block Works, Lockport, N.Y.

Gold, Silver, and Nickel Plater wants a situation. Address Plater, Waterbury, Conn.

Wanted.—Low priced, second hand Lewis, Oliver & Phillips Bolt Header. G. C. Chase, Manchester, N. H.

H. Prentiss & Co., 14 Dey St., N. Y., Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Extension of time.—Proposals for Jacksonville Water Works will be received until November 21, 1878. See advertisement page 237, October 12, 1878.

Emery in bbls. and cans, all numbers, Polishing Supplies. Greene, Tweed & Co., 18 Park Place, New York.

Right to manufacture a salable patented article desired by an old established house; would pay royalty or purchase. G. Thomas, Box 23, West Troy, N. Y.

Useful Books for Engineers and Mechanics. Catalogues free. E. & F. N. Spon, 446 Broome St., New York.

Wanted.—A foundry foreman with experience in melting for malleable and gray castings. Address, stating wages expected, references, etc., 2116 Market St., St. Louis, Mo.

Dead Pulleys, that stop the running of Loose Pulleys and Belts, taking the strain from Line Shaft when Machine is not in use. Taper Sleeve Pulley Works, Erie, Pa.

Pulverizing Mills for all hard substances and grinding purposes. Walker Bros. & Co., 23d and Wood St., Phila.

The Lawrence Engine is the best. See ad. page 286.

For the most substantial Wood-Working Tools, address E. & F. Gleason, 52 Canal St., Philadelphia, Pa.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Manufacturers can save 25 per cent of customary outlays by use of H. W. Johns' Asbestos Liquid Paints, which are of a higher grade than any other paints in use.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J. English Agency, 18 Caroline St., Birmingham.

Boilers ready for shipment, new and 2d hand. For a good boiler, send to Hilles & Jones, Wilmington, Del.

Punching Presses, Drop Hammers, and Dies for working Metals, etc. The Stiles & Parker Press Co., Middletown, Conn.

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The Cameron Steam Pump mounted in Phosphor Bronze is an indestructible machine. See advertisement.

We make steel castings from ¼ to 10,000 lbs. weight, 3 times as strong as cast iron. 12,000 Crank Shafts of this steel now running and proved superior to wrought iron. Circulars and price list free. Address Chester Steel Castings Co., Evelina St., Philadelphia, Pa.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

The genuine Asbestos Steam Pipe and Boiler Coverings are the most durable, effective, and economical of any in use. H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, are the sole manufacturers. Do not be deceived by worthless imitations.

Oak Tanned Leather Belting, Rubber Belting, Cotton Belting, Round Leather Belting. Greene, Tweed & Co., 18 Park Place, New York.

Machine Cut Brass Gear Wheels for Models, etc. (new list). Models, experimental work, and machine work generally. D. Gilbert & Son, 212 Chester St., Phila., Pa.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Wheels and Pinions, heavy and light, remarkably strong and durable. Especially suited for sugar mills and similar work. Pittsburgh Steel Casting Company, Pittsburgh, Pa.

Self-feeding upright Drilling Machine of superior construction. Drills holes from ⅛ to ⅞ in. diameter. Pratt & Whitney Co., Manufs., Hartford, Conn.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in Scientific American of this week.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., U.S.A.

The Turbine Wheel made by Risdon & Co., Mt. Holly, N.J., gave the best results at Centennial test.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St. Wm. Sellers & Co.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

Address Star Tool Co., Providence, R. I., for Screw Cutting Engine Lathes of 13, 15, 18, and 21 in. swing.

Latest and best Books on Steam Engineering. Send stamp for catalogue. F. Keppy, Bridgeport, Conn.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

The SCIENTIFIC AMERICAN Export Edition is published monthly, about the 15th of each month. Every number comprises most of the plates of the four preceding weekly numbers of the SCIENTIFIC AMERICAN, with other appropriate contents, business announcements, etc. It forms a large and splendid periodical of nearly one hundred quarto pages, each number illustrated with about one hundred engravings. It is a complete record of American progress in the arts.

Best Wood Cutting Machinery, of the latest improved kinds, eminently superior, manufactured by Bentel, Margedant & Co., Hamilton, Ohio, at lowest prices.

Presses, Dies, and Tools for working Sheet Metals, etc. Fruit and other Can Tools. Bliss & Williams, Brooklyn, N. Y., and Paris Exposition, 1878.

Notes & Queries

(1) G. S. Y. writes: Is the manufacture of sugar from the beet root a success? Are there any factories for its manufacture in this country, and if so, where located? A. Consult the SCIENTIFIC AMERICAN SUPPLEMENT, pp. 1947, 1963, 1324, 1032, and SCIENTIFIC AMERICAN, p. 169, vol. 37.

(2) A. F. B. asks: 1. Was there a good and sufficient reason for basing our system of numeration upon 10 rather than 12 parts? If so, what? A. The decimal system is not the best; but it is historical, founded on the circumstance that we have ten fingers and not twelve, or any other number. 2. What sufficient reason is there for spelling contrary to pronunciation? A. No reason but custom. 3. Are any or all of the other branches equally faulty? A. All human devices fall short of ideal perfection.

(3) J. M. McC. asks: 1. What are the capabilities of a rather strong medical magneto-electric machine? Can I magnetize with it iron and steel and make magnets strong enough for a telephone; or strong enough to serve as magnets in a larger magneto-electric machine? Can I electroplate with it? A. Your machine is not suited to any of the purposes named. 2. By what rule can I calculate the size or length of wire required in the bobbins for a magnet of given size? A. The amount of wire varies with the use to which the magnet is applied. 3. What battery would be best for a good medical galvano-faradic machine—how many pairs? A. An ordinary sulphate of copper battery, or two small cells of Marié Davy sulphate of mercury. 4. What size of induction coil? A. See p. 203 (14), current volume of SCIENTIFIC AMERICAN.

(4) S. B. T. asks (1) for a recipe for making glue to fasten leather to iron, in order to cover iron pulleys. A. 1 part of crushed nutgalls is digested 6 hours with 8 parts distilled water, and strained. Glue is macerated in its own weight of water for 24 hours and then dissolved. The warm infusion of galls is spread upon the leather, the glue solution upon the roughened surface of the warm metal; the moist leather is pressed upon it and then dried. 2. Also a good dressing to make rubber belts adhere to pulleys. A. We think you should use wider belts or larger pulleys if the adhesion is insufficient. It is a good plan to occasionally wash the worn surface of rubber belts with soap and water. 3. Also a glue for sticking leather to leather at splices. A. See recipes on p. 187 (5), in current volume.

(5) I. H. A. writes: I have been making a mercurial barometer. Can you tell me how to proceed to set the scale? A. Zero of your scale is at the level of the mercury in the cistern. The scale simply indicates the height in inches of the column of mercury contained by the tube.

(6) H. I. writes: A. says the whole working power of steam can only be obtained by an uninterrupted flow of steam from the boiler into the cylinder. B. says the same amount of power can be obtained if the steam comes from the boiler in puffs, provided these puffs are sufficiently rapid (say ten puffs per second). Who is right? A. We think it might be possible, theoretically, to obtain the whole power with either system.

(7) T. B. O. asks for a recipe for a walnut stain. A. Water, 1 quart; sal soda, 1½ oz.; Vandyke brown, 2½ ozs.; potassium bichromate, ¼ to ½ oz.; boil for ten minutes, replacing the water lost by evaporation. Use hot, and allow the work to dry thoroughly before oiling or varnishing.

(8) M. T. writes: 1. In the SCIENTIFIC AMERICAN of August 24 you give the plan of a simple phonograph, but you do not tell what proportions to make it by. How large should the mouthpiece be? A. 2¼ inches external diameter. The small aperture ½ inch diameter. 2. What size should the diaphragm be? A. 2¼ inches, leaving a portion, 1¾ inches diameter, free to vibrate. 3. What would make a good spring? A. Wood, steel or brass. 4. Will the machine work perfectly when properly made? A. Yes, with careful management. 5. What should the body of the instrument be made of? A. Wood of almost any kind. Mahogany, we think, would be best.

(9) E. E. writes: I want to make a Prussian blue that will dissolve in water. I have made a blue, but it is insoluble. A. Mix 1 lb. of the dry blue with a little hot water to form a paste, and triturate this with about 1½ oz. of potassium ferrocyanide (yellow prussiate).

(10) J. L. S. asks: What is the best polish for cleaning the end of the cylinder, and caps that fit over the end of the cut-off? A. One of the best is tripoli, applied with a piece of flannel and a drop of oil. If the metal is very dirty, use first fine emery or emery flour and oil. In some cases it is preferable to use first a little emery moistened with solution of oxalic acid in 5 or 6 parts of warm water.

(11) F. H. D. asks: Did you ever know the water to leave the gauge glass entirely after the fires had been banked under the boiler and the steam pressure gone down of its own accord? What is the cause of its doing so? It is a case that has come under my own personal observation, all the valves being shut at the time; when on opening the gauge cock and air being admitted the water will return gradually, until the water resumes its proper level in the boiler. A. It is not uncommon for water to fall in the gauge when steam goes down, and the boiler becomes comparatively cool; but in the case mentioned by you, as the water shows on the admission of air, we are inclined to think that the connections between the gauge and the boiler must be partly closed, and that there must be a small leak in the gauge through which air could enter as a vacuum formed in the boiler. Air entering the boiler through the gauge in this way would carry the water with it.

(12) H. D. H. asks: What is the intrinsic value of gold per ounce, both 14 carat and 18 carat fine? A. Coin value of fine metal 20·67 per troy ounce; 14 carat $\frac{14}{24}$ and 18 carat $\frac{18}{24}$ of this value.

(13) G. W. B. asks if forest leaves will answer for filling between the two walls of an icehouse built above ground. A. If the leaves are thoroughly dried, broken, and not too closely packed, they will answer the purpose very well. Sawdust, however, is considered preferable.

(14) E. P. writes: I am making a medicine (of which I am not the inventor; however it is a secret). Can I sell it, or must I have a license? A. If the medicine is not patented, we think you may sell it.

1. SCIENTIFIC AMERICAN, vol. 39, p. 171 (2), contains a recipe for a silver solution. I made it so, but took too much potassium cyanide to settle the silver nitrate, which produced a white foam. What is that foam, and what does the liquid contain? Can it be used yet, and how? A. If the water used was free from chlorides, the white body is silver cyanide. Dilute the mixture somewhat with warm water and let it stand, when the precipitate will settle. If too much potassium cyanide has been added, the supernatant liquid will give a fresh precipitate on addition of more silver nitrate. To prepare silver cyanide the proportion should be 85 parts of silver nitrate to 33 parts of dry potassium cyanide. 2. How much potassium cyanide for 1 gallon solution would you recommend? I have a few recipes which differ from 1½ to 8 ozs. A. The precipitate requires for its proper solution at least 33 additional parts of potassium cyanide dissolved in water. Electroplaters' baths usually contain much free potassium cyanide—water, 1 gallon; potassium cyanide, 9 to 12 ozs; silver cyanide, 1 oz. 3. How can I make a silver solution for a bright deposit? A. We know of nothing that will obviate the necessity of burnishing; polishing is not always necessary. It is said that a little sulphuret of carbon added to the plating solution prevents the chalky appearance and gives the deposit the appearance of metallic silver. 4. Does gold plating need any polishing? A. Yes.

(15) F. H. wishes to know what material is used to prevent rubber in vulcanizing from sticking to iron, brass or steel moulds. A. Soapstone (steatite) powder is used for this purpose.

Can you give me the address of some manufacturing firm where I can get iron such as used for tinning? A. From any large dealer in sheet iron.

(16) H. L. A. asks: What is the percentage of rosin oil in rosin? What is the residue, after the oil is distilled, used for? In what sort of stills is rosin distilled for oil making? A. When rosin is distilled it yields about 74 per cent of liquid distillation. The first portions, called essence of rosin, are yellow and strong smelling. Later in the distillation "pinolin," or rosin oil proper, passes over. The latter is used in paints, for the manufacture of printer's ink, in soap making and in cheap lubricators. The pitchy residue may be used for roofing and similar purposes. The stills may be constructed of iron.

(17) J. S. B. writes: In the September 7 number of the SCIENTIFIC AMERICAN you speak of "Mosso's plethysphygmograph." Please state what it is. A. It is the name given by Mr. Mosso to an instrument of his invention designed for observing the variations in the circulation of the blood in the arms, etc.

(18) W. H. B. asks for an electro silver plating solution; also what is the best mixture for removing grease, etc., from brass before plating. A. See p. 171 (2), current volume, SCIENTIFIC AMERICAN. To clean the brass dip it first in a strong boiling hot solution of caustic soda to remove grease, and (without touching) rinse with clean water, dip for a few moments in nitric acid diluted with two parts of water, rinse again and scour with fine clean sand and a stiff brush; then dip momentarily in the acid bath, rinse quickly, and transfer immediately to the plating bath.

(19) A. T. R. writes: At our temperance meeting recently there was a spirited discussion in reference to the composition of soda water, one man claiming that he could drink enough to produce intoxication; another claimed that its ingredients were wholly mineral, and therefore not intoxicating. A Common soda water is water supercharged with carbonic acid. It is not intoxicating. Some of the sirups used with it not unfrequently contain alcohol.

(20) A. T. J. asks: 1. What is the process for making artificial ice? A. There are several processes. See pp. 159 and 387, vol. 38, and 95, 168, and 335, vol. 37, SCIENTIFIC AMERICAN. Also pp 425, 507, 1159, 1430, and 1348, SCIENTIFIC AMERICAN SUPPLEMENT. 2. Will you please inform me of the name of some book which treats of the subject "Water," and that subject only. A. "Forms of Water"—Tyndall.

(21) C. K. asks how to fasten rubber on brass. A. Melt together in an iron vessel equal parts of pitch and gutta percha. Use moderately hot.

(22) E. W. E. asks: Is there any recipe to make cloth waterproof, and one to make it mildew proof? A. Pass the cloth slowly through a strong, boiling aqueous solution of yellow soap, and then digest for an hour or more in a strong bath of alum or lead acetate (sugar of lead) dissolved in water.

(23) F. G. H. asks: How can I make a good nickel plating liquid, and use it? A. Dissolve ¾ lb. of nickel ammonium sulphate, or 4 ozs. of the corresponding chloride, in a gallon of soft water. See article on nickel plating on p. 209, vol. 38, SCIENTIFIC AMERICAN.

Where can silk and cotton covered wire be bought? A. Of any dealer in telegraph and electrical supplies. See our advertising columns.

I saw somewhere that the saltness of the ocean and Great Salt Lake was owing to the water escaping only by evaporation. Is this true? A. The saltness is due to a greater loss of water by evaporation than otherwise.

(24) M. C. B. asks for a recipe for removing superfluous hair. A. See p. 107 (8), vol. 38.

Can you inform me how to give canvas a soft, black, waterproof coating that will not harden and crack off? A. Soften 2 parts of gutta percha with 3 or 4 parts of benzole by aid of heat over a water bath. Boil vegetable oil to the consistence of jelly, cool, and add 75 per cent of benzole. To seven gallons of this add three gallons of the gutta percha solution, and an additional gallon of benzole containing a sufficient quantity of lampblack, graphite, and boneblack to color.

(25) L. V. S. asks: Is there any substance known which will render copper more easily melted? If so, what is it? A. As we understand you, no.

(26) M. L. A. writes: 1. Two men pulling upon the ends of a rope in opposite directions, each one pulls 25 lbs. What is the strain on the rope? A. 25 lbs. 2. If one end is fast, and 25 lbs. weight applied on the other, what strain does the rope sustain? A. 25 lbs. + its weight.

(27) N. B.—See pp. 1326, SUPPLEMENT No. 83, and 48, current volume, SCIENTIFIC AMERICAN.

(28) A. I. asks for a good work which treats fully on the practical manufacture of Portland and other cements. A. Consult Reid's "Practical Treatise on Cements."

(29) I. E. P. asks: 1. Does any white lead used for painting or commercial purposes contain 98 per cent pure lead? A. No. Commercial white lead is a compound of lead carbonate and hydrate in variable proportions. In general the composition may be represented by the formula $2PbCO_3+PbH_2O_2$. 2. I get from a very fine article, after treating it with dilute nitric acid, a precipitate which does not entirely dissolve in muriatic acid, which would seem to show something besides baryta. What is it? A. It is frequently adulterated with barium sulphate (heavy spar), barium carbonate (witherite), calcium carbonate and zinc oxide, and sometimes with pipe clay or kaolin. Of these the first and last named substances remain as a residue after treatment with nitric and hydrochloric acids. The residue may also contain lead sulphate. 3. What is the best and most decisive test for white lead, and how can I ascertain the percentage of adulteration? A. See p. 269, Thorpe's "Quantitative Chemical Analysis."

(30) M. J. S. asks: 1. How can I separate small particles of emery gathered by means of an exhaust pan? We use wooden wheels covered with leather, upon which we glue No. 60 emery. The emery is still sharp, but cannot be used on account of the iron mixed with it. A. Use a magnet. 2. How can I cement leather to the periphery of an iron wheel, so that it will withstand continual jar, to be used as a buff wheel subjected to rough usage? A. Melt together in an iron vessel equal parts of pitch and gutta percha; roughen the iron and use the cement.

What is the best method for using exhaust steam to create a strong draught for two boilers 30 inches diameter and 30 feet long? A. Direct a thin flat jet of steam up the smoke stack.

(31) E. A. D. P. asks: Will well glazed earthen jars do for a battery for a short telegraph line, say ½ mile, as well as glass? A. Yes.

(32) C. L. writes: 1. In your issue of 28th ult., you describe a simple electric light. Should the carbon holders be made of brass? A. Yes. 2. Could the upright be made of varnished wood? A. Yes. 3. What is a Bunsen cell? A. See reply (24), p. 139, current volume of SCIENTIFIC AMERICAN. 4. Would the light produced by this apparatus be sufficient to light a room 20 x 20? Would several common copper and zinc batteries suffice? A. See reply to H. E. M., on next page.

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(33) C. S. writes: In the side of our cistern where the water remains after passing through the filter a large number of the germs of mosquitoes have made their appearance. In fact the water is thick with them. Is there any remedy? A. Burn a fragment of sulphur in the cistern, and keep the cover on tight; the mosquitoes, finding no outlet, will soon die, and no more will trouble you.

(34) D. W. C. asks: What is the source of the driftwood appearing off the north coast of Ireland every year? The fact is mentioned by Simms in proof of his North Pole theory. A. The wood is probably carried northward by the Gulf Stream.

(35) F. T. asks: Is there a known coppering solution capable of being applied to tin plate? If so, please let me know the ingredients and application. A. Suspend the work to be plated, first thoroughly cleaned, facing a plate of copper of equal surface in a cold saturated aqueous solution of copper diluted with ¼ volume of water Then, by means of stout copper wire, connect the work with the negative or zinc pole, and the copper anode with the positive pole of a Smee (1 gallon zinc carbon) battery in zinc surface exposed, somewhat exceeding the surface of the work exposed in the plating bath.

(36) R. F.—Genuine gutta percha is rendered sufficiently soft by boiling water or steam to mould by pressure. It cannot be rendered liquid by heat without partial decomposition. It dissolves readily in carbon disulphide and in warm naphtha or benzole.

(37) J. C asks for the formula of a baking powder. I have four of the ingredients and lack only the fifth, which you can supply Cream of tartar 4 lbs., bicarbonate of soda 2 lbs., powdered alum 1 lb., corn starch, 3 lbs There is still another ingredient. Please let me know what it is, and the proportion. A. See p. 299 (32), vol. 37. Alum is not a proper constituent for baking powder.

(38) L W. A. M. asks whether grinding iron on an emery wheel is injurious to health. A. Yes, very, unless the dust is carried away by an exhaust fan.

(39) H. E. M.—The simple electric light apparatus described on p. 200 of current volume is designed merely as an experiment. It is not calculated for continued use. It will take 15 or 20 cells of zinc and copper battery.

(40) M. J C. writes: In observing the planets, and Jupiter in particular, through a first class telescope, can the shadow of the planet be seen projected in space in a direction opposite to the sun? A. No.

Has any method ever been discovered by which lenses can be ground accurately in the form of a segment of an ellipsoid, and would not a lens of this form be free from chromatic and spherical aberration? A. Lenses and specula have been ground in parabolic form by hand and by machine. Telescopic specula of this form are free from the imperfections found in spherical mirrors.

(41) W M. E. writes. 1. Mechanics here say that a patch of new iron put on the inside of the firebox of a boiler over the old iron, without cutting out the old, will make the old burn out faster than it would without the new patch. I can see that the patch would last longer to have water come next to it, but I claim that the old will not burn out until the new is gone. Is this sound? A. The thicker you make the metal with which the flame comes in contact, the less rapidly will the heat be conducted through it, and hence the more rapidly will it burn out. 2. Are ⅝ inch stay bolts once in 6 inches each way, for 18 horse power boiler, in firebox, enough to be safe? Boiler iron $\frac{5}{16}$. A. It depends on the pressure of steam. 3. Give the best and cheapest outside coating for boiler to keep heat in. A. Wisps of straw with a little clay make a very effective coating. Cow hair felt is also very good.

(42) C. M. S asks: Will you give me a recipe for a waterproof cement, one that will harden immediately after the application? A. See p. 187, current volume, SCIENTIFIC AMERICAN, and answer to G. P. P., below.

(43) C. A. T asks (1) if potatoes have any salt in them A. Salt (sodium chloride) is usually found in small quantities in the ash of potatoes. 2. Is salt a mineral? Can minerals exist in vegetables? A. Yes. You should consult some work on agricultural chemistry.

(44) G. P. P asks: What is the strongest and best cement made, and is there any cement made that will unite rocks or pebbles tightly together? Is there any glue that water will not affect? A. For general purposes those given in answer to T. B. A., J. L., and others, p. 187, current volume, SCIENTIFIC AMERICAN, are excellent. Of these Nos. 2, 3, 4, and 5 are quite waterproof.

(45) S. W M.—As far as we can judge from the small sample, the liquor is simply raw whisky containing a notable amount of fusel oil (amylic alcohol).

(46) J. S. A writes: Can you give me the method used in preparing "buttons" of lampblack for use in the Edison carbon telephone? A. The carbon is compressed in suitable moulds under great pressure.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L P. S.—Principally iron sulphides—contains a little copper.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

The Gas Engine. By A. A. T
How to Test a Lathe. By C. A. S.
Forming a Right Angle. By A M. W.
Mine Explosions. By C. W. J.
Telephone. By A. T.
Railroad Signals. By S. F.
Telephone Experiments. By J. H. R.
Steam Joint. By J. H. B.
Constructing a Right Angle. By W. L. T.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

September 3, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Salve, Redding & Co 6,539
Smoking and chewing tobacco, Simmons & Staiger 6,533
Smoking tobacco, C. R. Messinger 6,530
Smoking tobacco, etc., The Amer. News Co 6,543, 6,544
Soap, D. S. Brown 6,549
Soap, D. S. Brown & Co 6,550
Woolen yarns, R. Blankenburg 6,527

DESIGNS.

Heating stoves, J. S. Van Buren 10,796
Inkstands, O. F. Fogelstrand 10,793
Oil cloths, C. T. Meyer & V. E. Meyer 10,794, 10,795
Organ case, R. W. Blake 10,792

[For the week ending August 27th.]

TRADE MARKS.

Baking powder, W. D. McLaren 6,517
Baking and yeast powder, Jewett & Sherman Co 6,520
Capsules for bottles, Betts & Co 6,510
Clothes wringers, Peerless Wringer Company 6,516
Cologne water, etc., D. S. Brown & Co 6,519
Files, New American File Company 6,514
Flour, J. O. Norris 6,515
Ladies' wearing apparal, Siegel Brothers & Co 6,522
Liquors, Rosskam, Gerstley & Co 6,523
Lumber, G. Bell & Sons 6,512
Paints and colors, A. Levesque 6,521
Preparations of cocoa, J. Epps & Co 6,513
Refined petroleum, Bowring & Archibald 6,511
Spool cotton, W. Warren 6,518
Wagons, carriages, etc., R. M. Stivers 6,524

DESIGNS.

Carpeting, E. Petit 10,790
Coffin handles, W. R. McComas 10,791
Playing cards, J. W. Nunen 10,789
Plug tobacco, Gravely & Lawson 10,787
Spoons, H. W. Hirschfeld 10,788

English Patents Issued to Americans.

From September 13 to September 24, inclusive.

Air compressor.—W. F. Garrison, Brooklyn, N. Y.
Arbor for spinning machine.—A. W. C. Williams *et al.*, Hartford, Conn.
Breech-loading arms.—J. Blumel, San Francisco, Cal.
Brush binder.—M. W. Marsden, Connellsville, Pa.
Door knobs.—J. F. Peacock *et al.*, Reno, Nevada.
Electric conductors.—E. F. Phillips, Providence, R. I.
Fare register.—C. B. Harris, New York city.
Glass targets.—C. A. Tatum, New York City.
Horseshoe machinery.—J. W. Chesnut, Pomeroy, Ohio.
Marine engine governor.—J. A. Svedberg, Washington, D. C.
Mowers.—C. H. McCormick, Chicago, Ill.
Ore separator.—E. B. Hastings *et al.*, Palmer, Mass.
Paper machinery.—I. Frank, New York City.
Pulley block.—J. L. Pope, Cleveland, Ohio.
Rail joint.—J. L. Pope, Cleveland, Ohio.
Railway switch.—J. S. Williams, Riverton, N. J.
Railway truck.—E. R. Esmond, New York city.
Show case.—J. H. Smith, Brooklyn, N. Y.
Spinning frames.—G. D. Edmands, Milford, Mass.
Stamp canceler.—R. Smeaton, Milwaukee, Wis.
Thills and harness.—R. B. Boynton, West Townsend, Mass.
Tongs.—W. L. Lay, Oil City, Pa.
Turbines.—J. H. Lidgerwood, New York City.
Veneer cutters.—H. S. Smith, —, N. Y.

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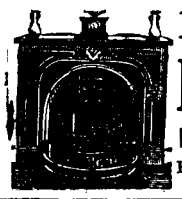

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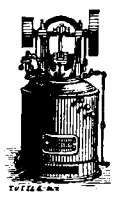

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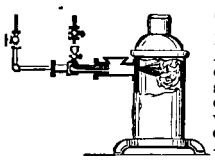

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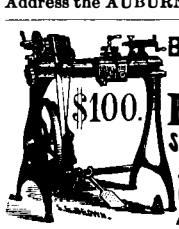

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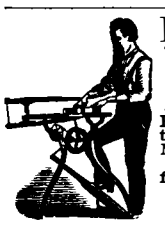

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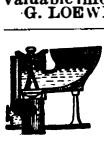

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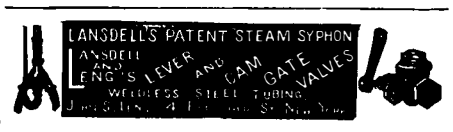

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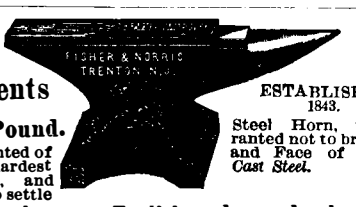

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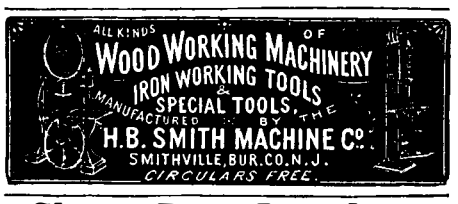

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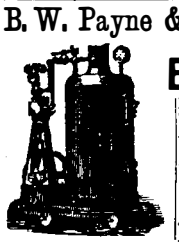

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